NAVY

Proposal Submission

The responsibility for the implementation, administration and management of the Navy SBIR program is with the Office of Naval Research. The Navy SBIR Program Manager is Mr. Vincent D. Schaper. Inquiries of a general nature may be brought to the Navy SBIR Program Manager's attention and should be addressed to:

Office of Naval Research
ATTN: Mr. Vincent D. Schaper
800 North Quincy Street, BCT #1, Room 922
Arlington, VA 22217-5660
(703) 696-4286

SBIR proposals shall not be submitted to the above address and must be received by the cognizant activities listed on the following pages in order to be considered during the selection process.

The Navy's mission is to maintain the freedom of the open seas. To that end the Navy employs and maintains air, land and ocean going vehicles and personnel necessary to accomplish this mission. The topics on the following pages represent a portion of the problems encountered by the Navy in order to fulfill its mission.

The Navy has identified 165 technical topics in this, the second of two SBIR solicitations to be released during FY 1993 by DOD to which small R&D businesses may respond. The reason for the increase in the amount of topics is due to a change in the law PL 102-564 which was signed by the President on 28 October 1992. Under PL 102-564, the "cap" for Phase I and Phase II was increased and the need for a process to fund the gap between Phases I and II was noted. Consequently, the Phase I proposals resulting from this Navy portion of the solicitation will be funded at a $70K level (unless otherwise noted) for the initial Phase I portion with an option phase also submitted with the Phase I proposal. The option should not exceed $30K and should propose an effort that would form the initial part of Phase II. Therefore, the total proposal submitted for this solicitation for the initial Phase I and the Phase I option will be $100K.

Those who have finished or almost finished their "initial Phase I" portion and who have been invited to submit their Phase II proposal should do so with an "initial Phase II" portion and an option. The Phase II proposal should contain a plan of how the proposer will commercialize the technology to the government (and the private sector) in addition to the technology demonstration portion of the proposal. At the end of the "initial Phase II" portion, a determination will be made by the Navy as to whether the proposer has satisfied the commercialization plan sufficiently for the government to fund the "Phase II option" portion of the proposal. The total Phase II funding will not exceed $750K with 80% going to the "initial Phase II" portion and 20% for the "option Phase II" portion.

Selection of Phase I proposals for funding is based upon technical merit and the evaluation criteria contained in this solicitation document. Because funding is limited, the Navy reserves the right to limit the amount of awards funded under any topic and only those proposals considered to be of superior quality will be funded.

NAVY SMALL BUSINESS INNOVATION RESEARCH PROGRAM

Submitting Proposals on Navy Topics

Phase I proposal (5 copies) should be addressed to:

Topic Nos. N93-133 through N93-140

Administrative SBIR Contact

Mail/Handcarry Address:

Office of Naval Research
Attn: ONR Code 11SP, Room 804
SBIR Program, Topic No. N93-_____
800 N. Quincy Street, BCT #1
Arlington, VA 22217-5660

Dr. Donald Polk
(703) 696-4103

Topic Nos. N93-141 through N93-150

Mail Address:

Commander
Marine Corps Systems Command
Attn: Code AW, SBIR Program, Topic No. N93-_____
Quantico, VA 22134-5080

Mr. Joseph Johnson
(703) 640-4801/2761

Handcarry Address:

Commander
Marine Corps Systems Command
Attn: Code AW, SBIR Program, Topic No. N93-_____
Building #3097, 2nd Deck, Room 13
Quantico, VA 22134-5080

Topic Nos. N93-151 through N93-177

Mail Address:

Commander
Space and Naval Warfare Systems Command
Attn: Code SPAWAR OOK, SBIR Program, Topic No. N93-_____
Washington, DC 20363-5100

Ms. Betty Geesey
(703) 602-6092

Handcarry Address:

Commander
Space and Naval Warfare Systems Command
Attn: Code SPAWAR OOK, SBIR Program, Topic No. N93-_____
Crystal Park #5, Room 110
2451 Crystal Drive
Arlington, VA 22202

Topic Nos. N93-178 through N93-180

Administrative
SBIR Contact

Mail Address:

Commander
Naval Supply Systems Command
Attn: Code SUP 4233D, SBIR Program, Topic No. N93-_____
Washington, DC 20376-5000

Ms. Linda Whittington
(703) 607-1648

Handcarry Address:

Commander
Naval Supply Systems Command
Attn: Code SUP 4233D, SBIR Program, Topic No. N93-_____
Crystal Mall #3, Room 710
1931 Jefferson Davis Highway
Arlington, VA 22202

Topic Nos. N93-181 and N93-182

Mail/Handcarry Address:

Commanding Officer
Naval Civil Engineering Laboratory
Attn: Code L03B, SBIR Program, Topic No. N93-_____
Port Hueneme, CA 93043-5003

Mr. Daniel Zarate
(805) 982-1057

Topic Nos. N93-183 through N93-188

Mail Address:

Commanding Officer
Navy Personnel Research and Development Center
Attn: Code 13, SBIR Program, Topic No. N93-_____
San Diego, CA 92152-7250

Dr. Meryl S. Baker
(619) 553-7681

Handcarry Address:

Commanding Officer
Navy Personnel Research and Development Center
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53335 Ryne Road
San Diego, CA 92152-7250

Topic Nos. N93-189 through N93-244

Mail Address:

Commander
Naval Air Systems Command

Mr. Tom Drago
(703) 692-7393

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Handcarry Address:

Administrative
SBIR Contact

Commander
Naval Air Systems Command
Attn: Code AIR-05TE2, SBIR Program, Topic No. N93-_____
1411 Jefferson Davis Highway
Jefferson Plaza #1, Room 444
Arlington, VA 22202

Topic Nos. N93-245 through N93-271

Mail Address:

Commanding Officer
Naval Air Warfare Center
Aircraft Division Warminster
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P.O. Box 5152
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Handcarry Address:

Commanding Officer
Naval Air Warfare Center
Aircraft Division Warminster
Attn: Code 01B, SBIR Program, Topic No. N93-_____
Street Road/Jacksonville Road
Warminster, PA 18974-0591

Topic Nos. N93-272 through N93-278

Mail Address:

Commanding Officer
Naval Air Warfare Center
Aircraft Division Trenton
Attn: Code PE31, SBIR Program, Topic No. N93-_____
Trenton, NJ 08628-0176

Mr. Robert Dobrowolski
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Aircraft Division Trenton
6250 Phillips Boulevard
Trenton, NJ 08628-0176

Topic No. N93-279

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Mailing Address:

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Aircraft Division Indianapolis
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Indianapolis, IN 46219-2189

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6000 East 21st Street
Indianapolis, IN 46219-2189

Topic No. N93-280

Mail Address:

Commander
Naval Surface Warfare Center
Dahlgren Division
Attn: Code R05, SBIR Program, Topic No. N93-_____
Silver Spring, MD 20903-5000

Mr. Donald Wilson
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Naval Surface Warfare Center
White Oak Detachment
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Building #1, Reception Room
Silver Spring, MD 20903-5000

Topic Nos. N93-281 through N93-287

Mailing Address:

Commander
Naval Air Warfare Center Aircraft Division
Flight Test and Engineering Group
Attn: Code CT222, SBIR Program, Topic No. N93-_____
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Handcarry Address:

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Flight Test and Engineering Group
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Building #304
Patuxent River, MD 20670-5304

Topic Nos. N93-288 through N93-291

Administrative
SBIR Contact

Mailing Address:

Commanding Officer
Naval Research Laboratory
Attn: Code 3204, SBIR Program, Topic No. N93-_____
Washington, DC 20375-5326

Ms. Patricia Schaefer
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Commanding Officer
Naval Research Laboratory
Attn: Code 3204, SBIR Program, Topic No. N93-_____
4555 Overlook Avenue, SW
Building, 222, Room 115
Washington, DC 20375-5326

Topic Nos. N93-292 through N93-295

Mailing Address:

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Naval Air Warfare Center
Weapons Division
Attn: Code C002, SBIR Program, Topic No. N93-_____
China Lake, CA 93555-6001

Ms. Lois Herrington
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Commander
Naval Air Warfare Center
Weapons Division
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China Lake, CA 93555-6001

Topic No. N93-296

Mail Address:

Commanding Officer
Naval Command, Control and Ocean
Surveillance Center (RDT&E) Division
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San Diego, CA 92152-5043

Dr. Richard November
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Naval Command, Control and Ocean
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San Diego, CA 92152-5043

Topic No. N93-297

Administrative
SBIR Contact

Mailing Address:

Commander
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Weapons Division Point Mugu
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Mr. Eugene Patno
(805) 989-8801

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Commander
Naval Air Warefare Center
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Building 50, Room 1092
Point Mugu, CA 93042-5000

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DEPARTMENT OF THE NAVY
SBIR TOPIC INDEX
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OFFICE OF NAVAL RESEARCH

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N93-137 Acoustic Transducer Material Fabrication

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N93-139 Legged Vehicle for Underwater Mobile Operations

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N93-209 Identification of Alternative Compliant Refrigerants to Replace Ozone Depleting Substances (ODS) Chemicals for Air Conditioning/Refrigeration Purposes in F/A-18 Aircraft.

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N93-211 Development of Surface Mount Repair Tools/Operator Training

N93-212 Electronically Erasable Programmable Read Only Memory (EEPROM) Failure Mode Analysis

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N93-221 NDE/I Assessment of Heat Damage to Advanced Composites

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N93-224 Conformal UHF SATCOM Antenna for Tactical Aircraft

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N93-226 Integrating Computer Aided Curing of Composites with Advanced Tooling Concepts **(CANCELLED)**

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N93-232 Government Wide/Para-Military Applications of Unmanned Air Vehicles (UAVs)

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N93-240 Sidewinder 9X Missile Domes **(CANCELLED)**

N93-241 Simulation Enhancement of the FA-18 Flight Simulation with Special Emphasis on Departures and Out-of-Control Airplane Motions and Control Power **(CANCELLED)**

N93-242 NDE/I Assessment of Adhesive Bond Strength **(CANCELLED)**

N93-243 Aircraft Repair and Modification Cost Estimating Query System

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NAVAL AIR WARFARE CENTER/WARMINSTER

N93-245 Forward Looking Infrared (FLIR) Image Enhancement

N93-246 Antenna/Airframe Math Model

N93-247 Low-Cost Tow Preg.

N93-248 Low-cost Prototype (Composite) Tooling

N93-249 Fabrication of Thermoplastic Secondary Structures for V-22

N93-250 Woven Structure/Resin Transfer Molding

N93-251 Onboard Electrical Load Management of V-22 Aircraft Power Systems

N93-252 Innovative ECM System for Tilt Rotor/Rotary Wing Aircraft

N93-253 Metal Matrix Composite Components

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N93-255 Simplified "Health of the Aircraft" Sensing System

N93-256 CBR Agent Detector for the V-22

N93-257 Agent Decontamination for the V-22

N93-258 Laser Radar for Terrain Following/Terrain Avoidance (TF/TA)

N93-259 Composite Cockpit Cage

N93-260 High Temperature Advanced Composite Drive Shafts

N93-261 Covert Forward Looking Sensor for V-22

N93-262 Explosive Sound Source Design Aid **(CANCELLED)**

N93-263 Variable Coherent Sound Source

N93-264 High-Temperature Self-Lubrication Ceramic Bearings

N93-265 Fiber-Optically Coupled Laser Beam Forming and Steering Device for Multipurpose Airborne Laser Application

N93-266 High Speed Low-power Optical Receiver with Clock Recovery for Digital Communications

N93-267 High Density Power Amplifier for Low Frequency Active Sonobuoys

N93-268 Loading System for Nondestructive Testing

N93-269 Machinability of AF 1410 and AerMet 100 High Strength Steels

N93-270 Compact Tunable Optical Filter for Fiber Optic Communications

N93-271 Genetic Algorithms for Flight Control Optimization

NAVAL AIR WARFARE CENTER/TRENTON

N93-272 Powder-Metallurgy Net-Shape Process

N93-273 Lightweight, Active Noise Suppression for Small Diesel Engines

N93-274 Innovative Lightweight Hybrid Diesel/Electric Propulsion System for Unmanned Air Vehicles (UAV)

N93-275 High Speed and Temperature Counter-Rotating Intershaft Seals for Aviation Turbine Engines

N93-276 Next Generation Electrochemical Machining (ECM) Electrolytes

N93-277 Innovative and Durable Flexible Shafts For Power Transmission In Unmanned Air Vehicle Propulsion Systems

N93-278 Performance Optimizing Full Authority Digital Electronic Control (FADEC) for High Speed Spark Assisted Diesel Engines

NAVAL AIR WARFARE CENTER/INDIANAPOLIS

N93-279 Embedded GPS Requirements (EGR) Compliant GPS

NAVAL SURFACE WARFARE CENTER/DAHLGREN - WHITE OAK

N93-280 Significance of Ultrasonic Detected Defects in Composites

NAVAL AIR WARFARE CENTER/PATUXENT RIVER

N93-281 Ice Impact Protection for Thin Skin Composite Laminates

N93-282 Sensors for Icing Avoidance, Detection and Accretion Measurement

N93-283 Flight Test Instrumentation to Measure Rotor System Motion and Loads in Navy Helicopters

N93-284 Real Time Simulation Aerodynamic Updates for Flight Test Support

N93-285 Ship Based Helicopter Position/Motion Resolving Instrumentation System

N93-286 Flight Test Instrumentation to Measure Rotor System Motion and Loads in Navy Helicopters

N93-287 Variable Twist Rotor Blade to Optimize Tilt Rotor Aircraft Performance

NAVAL RESEARCH LABORATORY

N93-288 Rapid Prototyping and Simulation with Programmable Gate Arrays

N93-289 Airborne Sensor Front End Signal Processing Unit

N93-290 Airborne Multispectral Sensor Arrays

N93-291 Passive Tracking for Countermeasure Effectiveness

NAVAL AIR WARFARE CENTER/CHINA LAKE

N93-292 Pulsed Detonation Engine

N93-293 M197, 20mm Sabot Deflector Retrofit Kit **(CANCELLED)**

N93-294 Electrochemical Milling/Finishing of Rifling in Gun Barrels

N93-295 Develop an Improved Thrust Vector Control Jet Vane

NCCOSC/NRAD/SAN DIEGO

N93-296 Microcircuit Device Package Marking and Recognition

NAVAL AIR WARFARE CENTER/POINT MUGU

N93-297 Integrated IR/RF Scene Generation for Closed-Loop Missile Engagement Simulators

DEPARTMENT OF THE NAVY
SBIR TOPIC DESCRIPTIONS
DOD SOLICITATION 93.2

OFFICE OF NAVAL RESEARCH

N93-133 TITLE: (Scanning Tunneling Microscope) STM-Based Instrument for Nanolithography

CATEGORY: Research; Semiconductor Materials and Microelectronic Circuits

OBJECTIVE: To develop an STM-type instrument with a wide scan field (20 Ïm by 20 Ïm minimum) where the tip can be moved laterally at a speed of at least 20 um/s and be positioned with an accuracy of 10 nm or better. The instrument should be able to accommodate a full 3-inch wafer.

DESCRIPTION: Proximal probe techniques based on the scanning tunneling microscope (STM) are important for lithography because the low energy, spatially confined electron beam can be used to fabricate and characterize structures in the nanometer size regime. Present instruments have limitations in accuracy and throughput due to the nonlinear and limited time response of the piezo actuators used for moving the STM tip. The voltages applied to the actuators do not give a sufficiently accurate measure of the position of the STM tip. Both optical (interferometric or deflection) and electronic (capacitive) approaches may be considered for monitoring tip position. Parallel fast and slow servo systems may be required to achieve the desired scan speed and accuracy. A coarse sample positioned and optical microscope access for tip/sample alignment are required. The instrument should be capable of operating in a controlled ambient and in ultrahigh vacuum (< 10^{-10} torr). (funding for this Phase I topic will not exceed $60,000)

PHASE I: Demonstrate the feasibility of an instrument with the above specifications by developing an overall system design and validating this design through fabrication and characterization of critical subsystems.

PHASE II: Develop and optimize the full instrument which must include a state-of-the-art translation stage for accurate (< 5 nm) lateral movement of the sample to reposition the tip to a different 20 Ïm by 20 Ïm scan field.

PHASE III: Develop an instrument suitable for DoD and commercial lithography applications. This version should be expandable to accommodate an array of independently movable (in x, y & z) tips for increased throughput. The above listed specifications for speed and accuracy will be required for each tip.

N93-134 TITLE: Super High Density Memory Device

CATEGORY: Research; Electronics

OBJECTIVE: To develop super high density digital memory device capable of storing, reading, and writing 25 terabits per square centimeter with bit-access time in the tens of nanoseconds.

DESCRIPTION: The inexhaustible demand for higher density has pushed the digital memory device technology to megabits using solid state devices. An innovative approach to super high density digital memory is to use Scanning Tunneling Microscope (STM) as the driver for writing and reading bits of stored information at the atomic level. A cluster of a few atoms, deposited in a small area called a unit cell, can serve as the basic structure for storing one bit of information. The presence and absence of the small cluster of metal atoms within the cell can be read by the STM probe to indicate the bit of information. Since the unit cell can be as small as 2 nm, the memory density can approach 25 trillion bits per square centimeter. This is five orders of magnitude more dense than the densest solid state memory chip today (256 MB). The writing process consists of deposition of a cluster of metal atoms in a cell of the thin film lattice, and the reading process is the scanning of the cells in sequence in order to detect the presence of the metal atom clusters. Bit access time approaching the tens of nanoseconds appears to be possible using the STM. Other approaches will also be considered if they can achieve the same or better packing density and access time. (funding for this Phase I topic will not exceed $60,000)

PHASE I: Demonstrate the feasibility of using thin film substrate as a medium for the storage of digital bit information and using the STM as a driver to read and write the unit cells at the required dimensions and speed. The strength of the signals from the STM to drive the sense amplifier and the reliability of bit-detection will be demonstrated.

PHASE II: Full scale development of the super high density digital memory device to achieve the 25 terabit per square centimeter density and tens of nanoseconds bit-access time. The product is expected to be a fully developed super high density digital memory system that is compatible with conventional memory systems for digital computers and/or video storage systems.

PHASE III: The product developed under Phase II is to be made available and aggressively marketed to the computer and video storage industry. This phase is not expected to be funded by the Government.

N93-135 TITLE: 4-Dimensional Oceanographic Instrumentation

CATEGORY: Research; Weapon System Environment

OBJECTIVE: To develop innovative instrumentation to measure oceanographic/meteorologic parameters

DESCRIPTION: Innovative sensors/projectors and measurement techniques are solicited to obtain marine atmospheric and/or oceanographic (acoustical, optical, physical, biological, chemical, and geophysical) variables in 3D space and time. The emphasis is on (1) novel approaches and concepts for measuring multiple parameters coherently in 4D; (2) new methods of measuring fluxes, acoustic wavefields, or fluid motion of mixtures (i.e. water/bubbles/sediments/ biologics). Instruments can be towed/tethered sensors/projectors, elements in arrays, or suites of instruments on ROVs (remotely operated vehicles) to cite a few examples. Low cost, reliable, and/or expendable sensors/projectors and components (e.g. broadband, large dynamic range, high efficiency, compact, low power consumption projector/receivers) are particularly desirable. Full depth capability is desired in instrumentation planned for subsurface use. (funding for this topic will not exceed $60,000)

The PHASE I proposal should provide a description of exactly what will be measured and to what accuracies and coherence as well as providing the design concept for achieving the measurements. Phase I should produce a proof of concept by demonstrating untested concepts or instruments.

PHASE II would develop hardware and demonstrate feasibility in the laboratory. Field testing should be addressed via coordination with ongoing ONR field efforts. Potential approaches to industrial development that transition program output should also be outlined.

PHASE III would initiate production of hardware for both commercial and military monitoring of oceanographic and/or marine atmospheric parameters.

N93-136 TITLE: Low Power Mass Storage Devices

CATEGORY: Research; Semiconductor Materials and Microelectronic Circuits; Signal Processing

DESCRIPTION: Mass storage devices (MSD) are now available commercially that range from 0.5 to 4 Gbyte storage capacity, permitting unprecedented amounts of data collection. These devices, typically 10 watts of power, have been adapted or developed for computer peripherals, assuming a constant source of power. Many oceanographic instruments powered by batteries, however, sample at low rates (typically less than 100 samples/second), and buffer the data in memory before transfer to the mass medium for final storage. To minimize power consumption, the MSD's are powered down when not in use. When power is applied prior to transfer, almost every device has to recycle through all the prior data to find the next point on the medium for writing. This consumes most of the power utilized in operating the MSD, not in actually transferring the data. What is urgently needed is an MSD capable of operating in harsh environments (-10^{o}C to $+100^{o}$C, +/- 45^{o} tilt, vibration, etc.) that can be powered on/off with minimal time spent relocating the write pointer. Oceanographic/environmental usage potentially could exceed 10,000 units, with commercial adaptation to portable computers powered by battery for subsurface use. (funding for this Phase I topic will not exceed $60,000)

PHASE I: Design or adapt currently available MSD controllers, software, and/or hardware to determine the feasibility of immediate write capability for devices capable of over 500 Mbyte capacity under harsh environmental conditions. If funds allow, construct/modify a prototype device.

PHASE II: Apply the knowledge gained in Phase I to build several devices that can be placed in existing oceanographic instrumentation and tested under real-world conditions.

PHASE III: Depending upon the results in Phase II, finalize the design, and mass produce (100's) the MSD device for other DoD/Navy instruments. Commercialize and fabricate the MSD for portable computer peripherals.

N93-137TITLE: Acoustic Transducer Material Fabrication

CATEGORY: Research; Passive Sensors; Signature Control

OBJECTIVE: Devise cost-effective methods to synthesize innovative transducer materials for sensors and actuators.

DESCRIPTION: Previous research efforts have identified routes to enhance electro-mechanical transducer materials, for example, with piezoelectric ceramic/polymer composites. Such advanced materials promise significant improvements in the performance of many Naval and civilian systems, for example, pulse-echo acoustic imaging transducers used in undersea mine detection and medical diagnostics, and structural composites incorporating sensors and actuators for active control of vibrations in ships, aircraft, and automobiles. Cost-effective methods to synthesize these materials are essential to exploit such advanced materials concepts in Naval and commercial applications.(funding for this Phase I topic will not exceed $60,000)

PHASE I: Demonstrate potentially cost-effective methods to synthesize innovative transducer materials with enhanced properties. Identify targeted application(s) where these improved properties will have significant impact.

PHASE II: Optimize materials synthesis methods to demonstrate: (1) production of such materials in sufficient quantity and with sufficient reproducibility to permit their evaluation in prototype devices and (2) that eventual production costs will be sufficiently low.

PHASE III: Produce the advanced transducer materials in pilot line quantities and supply them to Naval and industrial laboratories for incorporation in practical device structures.

N93-138TITLE: Software Tools for Formal Specification and Verification of Distributed Real-Time Systems

CATEGORY: Research; Software Producibility

OBJECTIVE: To develop and demonstrate interactive software tools that support formal specification and reasoning about the temporal behavior, correctness, and safety of hard real-time systems.

DESCRIPTION: A number of advances have been made over the last several years in basic research on formal methods for specification and verification of hard real-time systems. Diverse approaches, ranging from temporal logics to timed automata to process algebras, have been developed, each with its own advantages and limitations with respect to expressibility, scope, proof complexity, scalability, etc. Ultimately, evaluation and comparison of these approaches will require implementation and validation on real (or representative) applications. Of particular interest to the Navy are tools that (1) support the formal specification and modeling of concurrency and timing constraints; (2) provide useful analyses of the formal specification to the user; and (3) exhibit scalability.(funding for this Phase I topic will not exceed $60,000)

PHASE I: Devise prototype components and demonstrate the feasibility of the proposed formal approach on generalizations of narrowly focussed research problems and representative subset(s) of real applications. Provide evidence of scalability (either theoretical or experimental). Develop a functional design for the complete toolset and a design for a robust, friendly user interface for the toolset. Develop a software design based on software engineering principles of the toolset. Formulate criteria for the quantitative and qualitative evaluation of the system, including experiments to be performed, measurements to be taken, and how they are to be interpreted.

PHASE II: Build a prototype of the complete toolset designed in Phase I. Demonstrate its power, scalability, and ease of use on a representative benchmark suite and evaluate the overall system using the plan established in Phase I. Refine the functional design, the software design, and the interface design based on the experimentation conducted in Phase I to the point where useful software tools can be built.

PHASE III: Construct a robust, maintainable, version of the toolset and make available to Navy sites involved in the design of C^3 systems. Commercialize the software for use in real-time process control, transportation, and communications applications.

N93-139 TITLE: Legged Vehicle for Underwater Mobile Operations

CATEGORY: Research; Robotics

OBJECTIVE: To develop a prototype small legged vehicle capable of stable locomotion underwater for the purpose of performing tasks in near-shore oceanic environments.

DESCRIPTION: Recent developments in small legged robots for terrestrial locomotion have demonstrated the feasibility of stable locomotion with minimal visual input. There is a need for underwater exploration of ocean bottoms for oceanography, bottom tomography, harbor pollution assessment, and ship husbandry, where some degree of autonomous control is desirable, and where currents or surges produce substantial perturbations. Biomechanical and neural analysis of invertebrate locomotion and recent concepts in coupled nonlinear oscillators are providing substantial opportunities for developing new adaptive control strategies for stable locomotion with on-board computational resources. This effort will develop a prototype capable of underwater legged locomotion in the presence of fluid perturbations.(funding for this Phase I topic will not exceed $60,000)

PHASE I: Demonstrate feasibility of a proposed design based on biological principles for a small legged vehicle capable of immersion and stable locomotion in the presence of perturbations that would be encountered in a shallow water environment. Formalize model for ambulation controller and specify performance requirements for actuators in a single leg implementation.

PHASE II: Develop and construct a prototype small legged vehicle, and demonstrate dynamically stable locomotion, maneuvering and navigation in a shallow tank with a sandy bottom and rock obstacles. Demonstrate stability in presence of waves or surges. At this stage of development the vehicle can be tethered with computer resources off-board.

PHASE III: Develop and construct a fully-autonomous legged vehicle capable of adapting to water currents and surge while navigating.

N93-140 TITLE: Active/Passive Hybrid Approach for Noise and Vibration Control

CATEGORY: Research; Signature Control

OBJECTIVE: Develop and demonstrate active/passive hybrid approach for noise and vibration control

DESCRIPTION: Active control of noise and vibration has received a great deal of attention and has achieved a certain level of practicality. However, active control methods have some drawbacks that are undesirable for many applications, including the potential for instability, need for significant power, and control complexity. An alternative, an active/passive hybrid approach (also known as adaptive passive), is attractive from simplicity and cost point of view. Active/passive hybrid methods utilize the reactive or damping characteristics of traditional passive techniques but have the capability to adapt parameters to optimize performance over a range of operating conditions. In contrast to active control, active/passive hybrid strategies add no energy to the system. Consequently, this alternative has no potential for instability and requires minimal power.(funding for this Phase I topic will not exceed $60,000)

PHASE I: Feasibility study: examine active/passive hybrid control concept and compare with active control and conventional passive techniques. Factors to be compared include acoustic performance, controller design, complexity of control system, and power consumption. Based on results of comparisons, select candidate(s) for further development and demonstration.

PHASE II: Develop active/passive hybrid control methodology and demonstrate concept. These efforts will be conducted in the laboratory with scaled models for the candidate(s) selected in Phase I.

PHASE III: Transition active/passive hybrid control methodology to practical and engineering problems.

MARINE CORPS SYSTEMS COMMAND

N93-141 TITLE: Gun System Calibration

This topic is CANCELLED.

N93-142 TITLE: Gun System Alignment Fixture

This topic is CANCELLED.

N93-143 TITLE: Universal Driver's Display

CATEGORY: Exploratory Development; Weapon System Environment

OBJECTIVE: Explore new and innovative approaches to display vehicle parameters to the driver and monitor vehicle and engine parameters that could result in failure.

DESCRIPTION: The current Drivers Display Unit displays 8 bar graphs that monitors various functions. The proposed replacement monitor should be a color capable screen (similar to a lap top screen) that would continuously display driver information such as: vehicle speed, engine speed, and vehicle compass heading.
In addition, the other parameters should be monitored continuously and displayed by exception. These parameters should be, but not be limited to: engine temperature, engine oil pressure, generator output, transmission oil pressure, and hydraulic system pressure. The display device should also have the capability of storing the exception information that may be accessed later by a laptop computer for maintenance diagnosis.

PHASE I: At the end of six (6) months, the contractor(s) should provide a number of approaches that are possible solutions to the problem. The proposals should be of sufficient detail to allow for government to consider follow-on research.

PHASE II: At end of the two year effort, it is anticipated that one or two technical approaches will have been installed and tested in an AAVC7A1 vehicle.

PHASE III: If successful, it is expected that such an approach will have immediate benefit for AAV, other combat vehicles and likely private sector.

N93-144 TITLE: Auxiliary Power Unit

CATEGORY: Exploratory Development; Weapon System Environment

OBJECTIVE: Explore new and innovative approaches for auxiliary electrical generation equipment.

DESCRIPTION: The current Auxiliary Power Units using usual materials, designs and implementations generally result in large bulky designs with limited performance inadequate for combat vehicle application.
Any proposed replacements should be of smaller size and lower weight than those commonly available. Specific desirable attributes and performance are as follows: 10-15 KW Total, 7.5 KW DC, 3-8, KW AC Weighs less than 175 pounds, diesel Powered, Low audible and smoke signature, Fits in a minimal space, i.e.,
17 x 17 x 42, Generally a one horsepower per cubic inch displacement for a 25 horsepower engine is considered good.

PHASE I: At end of six (6) months, the contractor(s) should provide a number of approaches that are possible solutions to the problem. The proposals should be of sufficient detail to allow for government to consider follow-on research.

PHASE II: At end of the two year effort, it is anticipated that one or two technical approaches will have been installed and tested in an AAVC7A1 vehicle.

PHASE III: If successful it is expected that such an approach will have immediate benefit for AAV, other combat vehicles and likely private sector.

N93-145 TITLE: Powder Metallurgy Processes for Net-Shape Complex Parts Using Dissimilar Materials

CATEGORY: Advanced Development; Composite Materials

OBJECTIVES: The goal of this topic is to develop powder metallurgical processes by which to form net-shape parts to be used in a variety of applications including projectiles and shaped-charge liners.

DESCRIPTION: Dissimilar metals, metalloid, alloys, or ceramics should be formed into structural composites without developing significant interfacial phases. The beginning powders, which will be provided by the government agency, will vary in density; the particle size will be less than 50 u.m. The powders should be evenly mixed, and structural parts should be fabricated from them. The parts are not restricted to a given geometry and may vary in size and shape.

PHASE I: The contractor will be responsible for delivering a report that will provide a summary of the background survey conducted on the topic, a detailed description of the approach that will be undertaken to solve the problem, and detailed projected production and scale-up costs (to project the costs, use the shapes described in Phase II). It is understood that some of the projected costs will vary depending on the complexity of the shapes produced. The contractor will also be responsible for providing two parts that demonstrate that the technology is feasible.

PHASE II: At the end of Phase II, the contractor will be responsible for delivering the following items: 1) Twenty five parts of each of the following geometries: a simple cone with a radius apex, and a hemispherical shell. The dimensions of the parts should be as follows: 1 inch in diameter, 1/2 inch in height, and a 0.050 inch in wall thickness. The allowable tolerances are as follows: wall thickness variation on transverse plane 0.0027 inch, goal variation 0.00004 inch; maximum variation in wall thickness throughout part 0.0030 inch, goal variation 0.0006; concentricity with casing 0.0023 inch, goal 0.0012. 2) A final report containing a detailed description of the process used to attain the parts, with information on different parameters, and specifically on percent theoretical density, whether this can be varied (a minimum and a maximum), and how it effects mechanical properties.

PHASE III: Provided successful completion of the ALE/MPTS effort, it is conceivable that this technology be incorporated in the production of the newly developed projectiles. Other programs currently in 6.2 and 6.3 categories could benefit from the use of this technology.

N93-146 TITLE: Shape Memory Material for Lashing and Rigging

CATEGORY: Exploratory Development; Composite Materials

OBJECTIVE: Identify and evaluate shape memory material systems for adaptation to sling and tie-down/restraint requirements.

DESCRIPTION: Current lashing and rigging systems are resource and time intensive. Reduction in resources and an increase in tempo associated with Navy littoral warfare and Marine Corps maneuver warfare operations requires faster equipment and materials securing and stowing methods aboard ships, lighters, ground vehicles and/or slinging method from air craft and helicopters. The lashing and rigging material system shall be capable of being relaxed or contracted by electrical, physical and/or chemical stimuli.

PHASE I: A detailed report shall be produced which describes the concept(s) and provides sufficient scientific and engineering analysis to substantiate its feasibility. Technologies identified must show the potential to be more efficient than current industry practice. A test plan shall also be developed for physical demonstrating candidate laboratory system(s) concept in Phase II.

PHASE II: Develop, test and evaluate candidate system(s) identified under Phase I. Candidate system(s) shall demonstrate the capability of proposed system(s) to have a potential capacity of 40 psi shear strength and a 10,000 lb., tie down strength.

PHASE III: Phase III effort is anticipated to take advantage of the results of this effort through the commercial sector and potential procurement with Marine Corps and other DoD applications.

N93-147 TITLE: Thermal Protection for Munitions Packaging

CATEGORY: Exploratory Development: Weapon System Environment

OBJECTIVE: Explore and evaluate off-the-shelf thermal protection systems to identify materials that will protect munitions in their shipping containers from fire and high heat exposure.

DESCRIPTION: Protecting munition containers to prevent explosive material from reaching the temperature at which they will undergo a violent thermally induced burning, deflagration, or detonation reaction.

PHASE I: Review NSWC (Naval Surface Warfare Center/Dahlgren Div) test results to determine feasibility of NDI technological application to existing munition containers.

PHASE II: Establishment of Department of Transportation (DOT) packaging standards for the use of thermal protection systems on munition containers. Selection of preferred thermal protection system. Application of thermal protection technology to existing munition containers. Evaluate alternative thermal resistant materials to be used in the construction of munition containers.

PHASE III: Incorporate thermal protection technology in the fabrication and manufacturing of munition shipping containers and existing specifications.

N93-148 TITLE: Toxic Free/Lead Free Small Arms Ammunition

CATEGORY: Exploratory Development; Weapon System Environment

OBJECTIVE: This topic has two objectives. First, explore and evaluate off-the-shelf toxic free/lead free small arms ammunition to resolve lead toxicity problems on firing ranges. Second, it is expected this research will aid in the development of a frangible or controlled penetration cartridge, currently required for Military Operations in Urban Terrain Training, through the development of new projectile compositions to eliminate use of lead.

DESCRIPTION: To eliminate toxicity, especially lead toxicity, of existing military cartridges to enhance user and environmental safety while maintaining weapon functionality and reliability. Additionally, to enhance live fire training opportunities by minimizing damage to training facilities through the use of frangible projectiles.

PHASE I: Evaluate NSWC preliminary results to determine possible NDI candidates for type classification.

PHASE II: Select NDI candidate, procure sufficient quantities for extensive type classification tests. Establish Joint Operation Requirements Document.

PHASE III: Proceed with full scale procurement actions.

N93-149 TITLE: Saboted Light Armor Penetrator Ammunition

CATEGORY: Engineering Development; Weapon System Environment; Flexible Manufacturing.

OBJECTIVE: Evaluate commercial engineering developments to improve the existing .50 caliber Saboted Light Armor Penetrator (SLAP).

DESCRIPTION: Improve the performance characteristics, composition, and manufacturing technique of the existing .50 caliber SLAP round while reducing unit cost.

PHASE I: Review NDI engineering developments to evaluate documented performance characteristics and cost proposals of a .50 caliber Improved-SLAP.

PHASE II: Procure different types of commercially available .50 caliber I-SLAP rounds to conduct performance tests. Select NDI candidate, procure sufficient quantities for extensive type classification tests.

PHASE III: Proceed with procurement.

N93-150 TITLE: Image Object Recognition Processor

CATEGORY: Advanced Development/Signal Processing

OBJECTIVE: Develop Compact Digital Real-Time Neural Network Image Object Recognition Processor.

DESCRIPTION: Neural networks have demonstrated the ability to extract objects and features from complex scene images generated from Video, IR, acoustic, and Rf sensors. The specific paradigms and the network weights are dependent on the architecture and training set. The ability to map the neural architecture and training set. The ability to map the neural architecture unto a chip or chips will provide a rapidly fieldable system. Neural architectures are composed of simple operations dependent on the paradigm and architecture. An architecture is necessary that will support the primitives of neural paradigms in Phase I. In Phase II the architecture will be integrated unto a chip or chip set. The real-time ability to extract objects will then be demonstrated.

PHASE I: Develop an architecture compatible with an IR imaging sensor supporting neural paradigms for object extraction and recognition.

PHASE II: Demonstrate the integration of the neural architecture into a chip or chip set. The real-time capability to extract and classify objects will then be demonstrated.

PHASE III: Develop and demonstrate the real-time capability of the neural architecture hardware to extract and classify objects. Target systems could include the Advanced Sensor for Air Defense Program, Expendable Artillery Remote Sensor (EARS) Program, or the Forward Observer Program.

SPACE AND NAVAL WARFARE SYSTEMS COMMAND

N93-151 TITLE: Quantum Overt Technique Exchange Systems (QUOTE)

CATEGORY: Research, Photonics

OBJECTIVE: Provide a means, based on quantum cryptography, of exchanging information for the purpose of discreet decision making.

DESCRIPTION: Quantum cryptography exploits the unavoidable disturbance of photons of light when an eavesdropper intrudes on a polarized communications channel employing light generators with quantum correlation. In cases where multi-level security is desired, where joint decisions are made based on separately private information, or where authentication is the issue, quantum cryptography may have important applications. Although devices have been built, they have mathematical inefficiencies. Schemes using an information-processing procedure called oblivious transfer have recently been described which could well be the most promising application of quantum devices.

PHASE I: Study the mathematical approach and feasibility of constructing a quantum device for use in short distance (local) links, such as a ship automatic switching system or a shore-based, multi-national control complex.

PHASE II: Demonstrate a proof of concept model at a land based operational setting.

PHASE III: A successful Phase II will have worldwide significance for DoD and a profound effect on commercial applications for privacy protection of individuals and businesses.

N93-152 TITLE: New Space Electronic Warfare (SEW) Synthetic Environment

CATEGORY: Exploratory Development; Machine Intelligence/Robotics

OBJECTIVE: The objective is to develop and demonstrate a methodology for generating a SEW synthetic environment and which will be suitable for worldwide internet connectivity.

DESCRIPTION: SEW system functional capabilities are offensive and defensive; and utilizes critical resources from three areas: Space and Surveillance, C4I and Electronic Combat. SEW is a new joint Warfare Area which integrates Surveillance, Electronic Combat, and Command, Control Computers and Intelligence (C4I). Few, if any, SEW system elements will be constructed and technical feasibility demonstrated using breadboard, brassboard or advanced development models, prior to a program decision milestone, where a value determination or military utility decision is usually made.
Program decision will be made, in the future, on performance estimates of simulated warfare supersystems of the highest complexity...that is, synthetic environments embodying many systems, of a great variety of sizes, shapes and performances, with many variables, netted together with other large scale synthetic environments. Once operating this complex supersystem defines the war fighting operational system of the future. To assure that SEW is made an integral part of the overall war fighting operational system of the future, it is important to develop and demonstrate a methodology for generating a SEW synthetic environment, which is compatible with the larger synthetic environment.

PHASE I: The basic thrust of the Phase I development is to investigate the requisite characteristics of the SEW synthetic environment, primarily for Navy elements. Synthetic environments are internetted simulations which represent activities with a high level of realism. These environments are fundamentally different from the traditional simulations and models known today. The basic Phase I goal is to produce an initial feasibility analysis, and develop an implementation or demonstration plan for Phase II.

PHASE II: Phase II should accomplish critical SEA synthetic environment developments and demonstrations. Potential Phase II developments include a preliminary synthetic design using a SEW environment configured with multiple netted PCs and interface design/adaption to agreed upon connectivity requirements. The implementation of the SEW synthetic environment should demonstrate realistic properties, limits and potentially useful features. This SEW synthetic environment should serve as entry to the larger synthetic war fighting environment.

PHASE III: This phase will transition preliminary synthetic designs into networked simulations of integrated Space and Electronic Warfare Systems.

N93-153 TITLE: Command and Control Information Management

CATEGORY: Engineering Development; Data Fusion

OBJECTIVE: Develop an automated decision support tool using Commercial Off-The-Shelf (COTS) software to devolve qualitative warfare information requirements to quantitative data elements for dynamic sensor collection and determine the value of quantitative sensor data to satisfy qualitative information needs.

DESCRIPTION: The Navy requires timely and accurate all-source early warning information at all command levels to maximize the use of available assets. To satisfy a Commander's Essential Elements of Information (EEIs) requires a means to translate qualitative information needs to quantitative data elements for technical sensor collection. It also requires a means to assess the value of reported data and the adequacy of specific EEIs. Phase I shall be a concept definition phase and survey of available COTS tools to support the development of an automated information-to-data and data-to-information process. Phase II shall provide a proof of concept demonstration of the process for operational testing. Each phase shall require an initial brief that details the Plan Of Action and Milestones (POA&M) for the phase, a final review, and a final report.

PHASE I: Phase I will provide a process model for demonstration in Phase II, an evaluation of COTS tools to implement the process, and a POA&M for Phase II.

PHASE II: Phase II will demonstrate a proof of concept system in a specified operational setting.

PHASE III: Phase III will transition a successful proof of concept to approved Navy systems for incorporation in the Unified Build.

N93-154 TITLE: Aegis Cueing from Acoustic Detection of Missile and Aircraft Overflight

This topic is CANCELLED.

N93-155TITLE: Decision Support Tool to Support Naval Force Planning

CATEGORY: Research; Simulation and Modeling

OBJECTIVE: Develop and demonstrate a decision support tool to support long range naval force and acquisition planning.

DESCRIPTION: An automated decision support tool that will allow U.S. Navy warfare systems architects and acquisition planners to assess and prioritize alternative force structures and alternative future systems acquisitions is needed. The system must be capable of comparing forces and systems across warfare mission areas and should allow the appraisal of naval forces to be based on contribution to joint war fighting capability. The system should be flexible enough to address a broad range of uncertainty. Navy and DoD decision makers must know that their choices will maximize warfare capability over a wide range of assumptions made in the size, composition and quality of projected threats, and in the conditions under which the future wars might be fought. The system is envisioned as a tool that will allow appraisals of alternative naval force structures and systems to be based on their ability to influence the outcome of a series of approved regional planning scenarios. However, the tool to be developed must resolve certain deficiencies that exist with current campaign level force-on-force models. The ability of naval forces to influence the outcome of a land campaign depends on the value to the campaign outcome of the operational tasks assigned to naval power projection forces and systems. The process is complicated by the requirement to protect high value launch platforms. To insure that the value of forces and weapons are accurately estimated, the tool must provide a systematic way to assign available resources to competing operational tasks and targets so as to maximize the benefit of the weapons to the campaign. to insure the opponent cannot negate the value of a force improvement by changing his strategy, the mechanisms must work for both sides. The system must also address the problem of timeliness. To support the decision process, the system, in its ultimate configuration, should be capable of supporting prompt analyses of a number of force structure alternatives. The required turnaround time may be as short as a few hours or days.

PHASE I: Design the configuration of the Phase II deliverable and develop a working prototype system. The prototype will be capable of estimating the value of example weapons systems across multiple warfare mission areas in multiple regional scenarios.

PHASE II: At the end of Phase II, the contractor will deliver a fully operational system with source code, operators manual and analyst guide.

PHASE III: A Navy funded Phase III effort is anticipated if a useful decision support tool is provided in Phase II.

N93-156TITLE: Periodically Time Varying Interference Filters

CATEGORY: Exploratory Development; Signal Processing

OBJECTIVE: Develop techniques for eliminating co-channel interference when both Signals of Interest (SOIs) and Signals Not Of Interest (SNOIs) are broadband and spectrally overlapping.

DESCRIPTION: Interference rejection filters in use today are based on the theory of time invariant linear systems which are optimal for use in a wide-sense stationary signal environment. These approaches include notch filters as well as adaptive transversal filters. Unfortunately, real signal environments almost always contain interfering signals which are not wide-sense stationary. In many cases however, the interfering signals are wide-sense cyclostationary or periodically correlated. It can be shown that a periodically time variant filter is optimal in these situations. Using a PTV filter, signals that are spectrally overlapping can be separated completely without degradation to the SOI.

PHASE I: Conduct a 6 month study to determine the value of periodically time varying FIR filters for separating spectrally overlapped signals. The study will involve simulation of the technique and processing combinations of several signal types.

PHASE II: Develop and implement the periodically time varying interference filter in a signal processing work station environment. Apply the technique to several real data sets. Data will consist of dense communications scenarios including cellular radio with frequency reuse.

PHASE III: The technique will be transitioned to a Government owned signal analysis work station. Another possible application is improved cellular communications.

N93-157 TITLE: Instantaneous Frequency Measurement Unit (IFMU)

CATEGORY: Advanced Development; Semiconductor Materials, Microelectronic Circuits

OBJECTIVE: Develop the capability to obtain more accurate and faster frequency measurement capabilities.

DESCRIPTION: Measure the frequency of an RF pulsed signal in the frequency range of 2-6 GHz (goal) within 100 nano-seconds (goals) of signal receipt. Resolution requirements are on the order of several megahertz or less. Size of the unit is to be as small as possible.

PHASE I: Phase I efforts will be to develop a preliminary design for further implementation. The Phase I proposals should address how the key features of the design will be capable of meeting the stringent timing and accuracy requirements. Design tradeoffs required to validate approach.

PHASE II: Phase II efforts will be to take the design of Phase I to the critical design phase. Final design trades and a proposal to take the IFMU to a hardware implementation is required.

PHASE III: Anticipated use of the IFMU is classified.

N93-158 TITLE: Remote Identification of Unique Artificial Materials

CATEGORY: Exploratory Development; Passive Signals

OBJECTIVE: Develop methods for producing low cost sensors or modifying existing sensors to remotely identify artificial materials that have unique spectral signatures.

DESCRIPTION: Design and fabricate low cost sensor systems capable of remotely identifying artificial materials having unique spectral signatures. Identification may be achieved through the detection of either reflected or emitted energy. The preparation of test materials, the fabrication of a prototype low-cost sensor, and proposed approaches for modifying operational sensors are required.

PHASE I: Will include the identification of candidate test materials along with a description of how these materials will be fabricated. The design of a low-cost sensor prototype will be generated. This design will include expected operational performance predictions with supporting analyses, top level schematics and drawings, a projected schedule for fabrication, and a cost projection for the production of operational sensors with supporting data. A detailed description of actions required to modify an existing sensor such as FLIR will be developed. The impact of the proposed modification will be identified.

PHASE II: Prepare unique test materials and obtain high resolution spectral signatures. Support collection exercises with panels ((4X8) feet) coated with the unique materials. Fabricate a low-cost sensor prototype and support testing in a simulated operational environment. Extend the modification analysis to additional sensor systems.

PHASE III: The use of remote identification of unique artificial materials in Navy operations is anticipated.

N93-159 TITLE: Beamforming a Free Floating Sonobuoy Field with Interference Rejection

This topic is CANCELLED.

N93-160 TITLE: Active Surveillance System Signal Processing for Dense Multipath Near Land Warfare Environments

CATEGORY: Exploratory Development; Signal Processing

OBJECTIVE: Develop, demonstrate, test and evaluate innovative LFA monostatic and bistatic active signal processing techniques that will improve detection and classification performance in the dense multipath environments associated with near land warfare.

DESCRIPTION: The increasing emphasis on active echo ranging in shallow water near land warfare environments requires that signal and signal sequence designs and processing algorithms perform well in dense multipath environments. The multipath structure is unknown or difficult to predict in shallow water and is changing in time due to non-uniform bottom topology within the source-target-receiver changing geometries and raypaths. Echo returns from the different multipaths are smeared in time and, when the paths are resolvable, produce similar smearing of the conventional matched filter output peaks. The task is to develop, demonstrate and measure innovative algorithms/techniques required to automatically combine multipaths for detection improvement and differentiate propagation multipath from target multipath to improve classification performance. Coherent combining using the latest adaptive filtering techniques as well as the more traditional incoherent post matched filtering techniques should be considered. LFA signal and signal sequence design options and multipath sorting in time and frequency are candidate study topics for detection and classification enhancements. A specific algorithm processing chain is desired along with the estimated processing gain improvements.

PHASE I: Develop algorithms and implement a software simulation of the critical candidate processing functions suitable for testing with simulated and recorded sea data. Provide preliminary test results along with a detailed algorithm description. Prepare Phase II Test Plan.

PHASE II: Develop a complete software processing chain suitable for near real time testing of large quantities of recorded sea data with commercial hardware and prepare a detailed algorithm and software specification.

PHASE III: Develop software and hardware for extensive on site testing and prepare on site test plans.

N93-161 TITLE: Fishing Vessel Contact Formation

CATEGORY: Advanced Development; Signal Processing, Passive Sensors

OBJECTIVE: To demonstrate the benefits of applying IUSS detection and classification capabilities to the protection of marine resources.

DESCRIPTION: The Navy's undersea surveillance mission requires highly capable personnel. To maintain the technical edge needed, and to continue to enhance capabilities in target identification and tracking, a need exists to perform in-depth analysis of acoustic data of interest which heretofore has been referred to as "background noise". This noise includes, prominently, emissions from commercial fishing vessels which produce identifiable acoustic signatures which can be monitored with current IUSS capabilities. Currently, there is a need in the fisheries community for the capability to perform wide-area search and to locate and classify fishing vessels in order to assist in the prevention of illegal exploitation of fisheries. Most prominently, efforts must be undertaken to limit worldwide whaling activities. In support of current and planned treaties, surveillance is needed to maintain a watch on whaling vessels and their prey; namely, the whales themselves. Fortunately, many of the whale species of interest are likewise strong acoustic sources, capable of being located, classified and tracked.

PHASE I: Provide a detailed feasibility study of the application of existing IUSS sensor systems for contact formation of commercial fishing vessels and whales. The feasibility study will include the use of both fixed (SOSUS) and mobile (SURTASS) acoustic arrays, including the potential benefit of dedicated flights of maritime patrol aircraft. Included should be a discussion of the optimal mix of sensors to be used, along with an estimate of results to be anticipated and an analysis of costs and benefits.

PHASE II: Design an experiment to collect signals of interest and to correlate them with known sources. With Navy cooperation, collect these data and analyze them. Demonstrate monitoring of fishing vessels engaged in various activities, and whales, individually or in groups.

PHASE III: Convert the techniques refined in Phases I and II to an on-line system usable by Navy ocean technicians, fisheries personnel and marine biologists.

N93-162 TITLE: Images from Low Frequency Active Sonar

CATEGORY: Exploratory Development; Signal Processing

OBJECTIVE: Develop a system to form images from Low Frequency Active returns for surveillance of diesel-electric and closed cycle submarines.

DESCRIPTION: Low Frequency Active multistatic systems can detect the very quiet targets of the future. As yet these systems have no classification capability. The problem is to provide such a capability by forming images of the target using multistatic Low Frequency Active returns. These returns could be observed at a number of nearby arrays and beamformed using self calibration techniques. The set of observing arrays would constitute a single wide aperture array with sufficient resolution to form an image of the target. The image would be used for classification. In particular, an untrained person can quickly distinguish textural qualities. Machine-assisted textural analysis could provide analysis of noise in sonar data, detection and classification of quiet sources, and advancement of machine vision.

PHASE I: Provide an analysis of the chosen imaging system. Include a discussion of receiving array type and location, self calibration technique, sensitivity, resolution and concept of operations. Include a conceptual visualization demo.

PHASE II: Design an at-sea experiment to collect data suitable for off-line processing to demonstrate proof-of-concept. With Navy cooperation, collect these data and analyze them. Using the lessons learned from this experiment, design a system for sea trials in Phase III.

PHASE III: The Phase III prototype system will be constructed with non-Navy funds.

N93-163 TITLE: Joint Surveillance Data Fusion

CATEGORY: Exploratory Development; Data Fusion, Signal Processing

OBJECTIVE: To develop algorithms to perform data fusion in a Joint Surveillance architecture.

DESCRIPTION: A Joint Surveillance requirement exists to provide systematic observation, tracking and dissemination of all activity (surface, subsurface, and air) within or affecting a theater of operations by all available sensors. Accomplishments of this will require integration of surveillance information from all sensor sources including Theater, Organic, and Non-traditional. Fusion of the data will provide users the ability to pull the required information to afloat or ashore activities, and will provide the mechanism to access the information aggregate. Surveillance information will be provided "bundled" in a usable format by contact, mission (ASW, ASUW, etc.) with tracks based on multiple sensors.

PHASE I: Conduct detailed analysis to determine the scope and bounds of the surveillance sensor fusion requirements needed to support a Joint Surveillance Program and examine potential algorithms and algorithm development to accomplish the data fusion and the timely dissemination to tactical users.

PHASE II: Design a system to demonstrate a Joint Surveillance Program using existing software and algorithms or new algorithms, as appropriate. Plan to test the Joint Surveillance Program in a realistic environment and support such an experiment. Provide an analysis of test results and recommendations in a final report. The Navy will cooperate and support the contractor's design, test and analysis efforts.

PHASE III: A transition to Phase III is planned.

N93-164 TITLE: Workstation Architecture as a Function of Open Systems Architecture Warfare Systems

CATEGORY: Exploratory Development; Parallel Computer Architectures, Weapon System Environment

OBJECTIVE: To determine how technology innovations related to the emergence of the Open Systems Architecture (OSA) philosophy can best be implemented in workstations that will be a part of future warfare systems.

DESCRIPTION: The two most far reaching recent developments in warfare systems design have been the use of the OSA philosophy in the design of computer systems and the advances in workstation technology. With these innovations, the complexion of warfare systems is rapidly changing. It is important that we understand the implications of these changes on warfare systems. This should be performed through analysis of the functional areas of a warfare system and, following the OSA concept, design of modules for the overall system that map to these functions.

PHASE I: Phase I will analyze the design and functionality issues in implementing OSAs in future workstations. At the end of six months a technical report covering implementation issues will be delivered. As part of this report, recommendations for the design features required in future warfare system OSA workstations will be developed.

PHASE II: Phase II will consist of implementing critical design features, as described in the Phase I report, in a workstation environment.

PHASE III: Results of this research are expected to be incorporated into TAC-5 and other workstation efforts.

N93-165 TITLE: Survey of Intrusion Detection Systems

CATEGORY: Exploratory Development; Machine Intelligence

OBJECTIVE: Evaluate intrusion detection systems to determine standard features required to safeguard Navy computing systems.

DESCRIPTION: One method of protecting computers and networks from unauthorized use is through the use of access controls, such as passwords; however, if these access controls can be compromised or bypassed, an abuser may gain unauthorized access and cause great damage and disruption to system operation. Although a computer system's first line of defense is its access controls, such mechanisms cannot be relied upon in every case to safeguard against penetration or insider attack. Even the most secure systems are vulnerable to abuse by insiders who misuse their privileges, and audit trails may then be the only means of detecting this type of abusive user activity. Intrusion detection systems detect unusual and anomalous computer system/user behavior and draw intelligent conclusions about the seriousness of that behavior, with the primary purpose of detecting misuse. Widespread use of intrusion detection systems required that standards be developed to facilitate commercialization. Exploratory development is needed which benefits from an evaluation of current intrusion detection systems and facilitates the recommendation of standard features required to safeguard Navy computer systems.

PHASE I: Identify and evaluate intrusion detection systems, both currently available and in development, and determine the ability of each to detect misuse in Navy computer systems. Develop recommendations for standard features for intrusion detection systems required to safeguard Navy computer systems. Priority should be placed on those features which facilitate commercialization.

PHASE II: Design/specify a prototype intrusion detection system which embodies the standard features recommended as part of the Phase I effort. Develop documentation and briefing materials to aid SPAWAR in preparing for a Phase III prototype development program.

PHASE III: Based on the results of Phase II, an intrusion detection system prototype development program may be pursued. Commercialization of this technology or a spin-off into the private sector is envisioned.

N93-166 TITLE: Development of Dynamic Management Tool for High Performance Local Area Networks

CATEGORY: Exploratory Development; Weapon System Environment

OBJECTIVE: Develop and prototype a software network management tool which allows a high performance network to make dynamic decisions as to which adaptable parameters and algorithms should be readjusted when the network experiences dramatic and abrupt change in command and control operations.

DESCRIPTION: Navy command and control systems require the effective use of message priority assignments and network resource utilization. It is critical that a high performance tactical (i.e. real-time) network for mission critical computer systems be able to dynamically adjust its network and system parameters and services, such as those associated with the MAC, Transport layer, flow control windows, and higher layer messaging. This adaptation must permit acceptable throughput and minimized delays to critical messages and streams, while best supporting other demanding messaging and imaging flows.

PHASE I: Phase I efforts will develop a detailed plan and analysis for incorporating the software developed in Phase II into a high speed local area network. The Phase I proposal should address how dynamic adjustments to the network are to be accomplished to maintain highly reliable network performance and how the reconfiguration of network parameters is to be initiated. The key tactical feature desired is the minimization of critical messages delays.

PHASE II: Develop engineer development models with the resulting software integrated into a fiber optic network, primarily the SAFENET profiles.

PHASE III: Anticipated future use in high speed Navy shipboard networks.

N93-167 TITLE: Distributed Real Time Computer Networks

CATEGORY: Exploratory Development; Weapon System Environment

OBJECTIVE: Identify requirements of a local area network (LAN) and a system of interconnected LAN's to support real time DOD applications, real time operating systems, and real time databases.

DESCRIPTION: As computer technology advances into the real time domain and as information technology advances into the distributed domain, there needs to be a computer communications paradigm to support future real time distributed systems. Computer communication protocols (FTP/TCP/IP, OSI 7 layers) began in the 1970's with the goal of interoperability between heterogeneous computer systems. Technology advances increased performance of computers and networks and interoperability is no longer the only functionality required of network protocols. Currently, ANSI and ISO are working on High Speed protocols to address the increased performance of hardware over the past 15 years. However, these address only efficiency issues and not realtime issues such as scheduling, predictability, synchronization, and latency control. Recently, research and development for predictability and scheduling of operating system processes have produced realtime operating systems for single platforms. As systems become more geographically distributed, these realtime mechanisms within the operating systems will require extensions into the communications area to transfer data and information in a predictable fashion to meet (sometimes critical) deadlines.

PHASE I: Survey of present technology and standards activity as well as Navy shipboard and ashore computer communications needs. This will identify the critical realtime parameters (e.g. latency, traffic priorities and scheduling, synchronization, bandwidth) and those technologies and standards that are addressing at least in part, the communications performance to meet these needs. Put together a plan to integrate these technologies into a distributed system that will meet these critical parameters. This includes integrating priorities and scheduling into the operating systems, protocol processing, LAN access, and inter-LAN connectivity (routing).

PHASE II: Model and simulate this system, using various Navy shipboard and ashore scenarios to demonstrate several realtime aspects of the system (e.g. traffic overload situation, scheduling distributed tasks, synchronizing events over different processors). This simulation should have a graphical interface to make the results easily understandable and demonstrable.

PHASE III: This distributed system will have various subsystems (e.g. network routers, network access protocols, operating system schedulers). Phase III could implement any number of these subsystems to verify the models.

N93-168 TITLE: Multimedia Technology Insertion into Open Systems Architectures

CATEGORY: Exploratory Development; Simulation and Modeling, Weapon System Environment, Data Fusion

OBJECTIVE: To determine how multimedia can best be implemented in emerging Navy Command and Control systems that will be implemented using an Open Systems Architecture (OSA) philosophy.

DESCRIPTION: Multimedia Technology (MMT) includes a broad spectrum of new and emerging capabilities for future Navy systems. These systems shall incorporate raw video, computer generated imagery, video image storage and retrieval, audio, interactive video, video conferencing, and their integration into true multimedia environments. In order for Navy Command and Control systems to exploit this technology, innovative approaches are needed to: 1) incorporate MMT into OSA, 2) acquire, store, and retrieve large quantities and new types of MMT data, and 3) determine standardized interfaces for MMT capabilities. Use of commercial-off-the-shelf MMT is encouraged.

PHASE I: Phase I will consist of the description and implementation of the engineering approach, resulting in a feasibility demonstration.

PHASE II: Phase II will consist of the selection of open system compatible interfaces and products, ending with demonstrations of their integration and utility in the C^2 arena.

PHASE III: Results of this research are expected to be incorporated into TAC-5 and other workstation efforts.

N93-169 TITLE: SHF/EHF Submarine Communications Mast Antenna

CATEGORY: Research; Submarine Antennas

OBJECTIVE: Develop a concept for a submarine RF mast antenna system which provides SHF and EHF transceiver communications. The system shall support present and future tactical communications requirements.

DESCRIPTION: Develop submarine RF mast antenna system concepts using one sail mounted retractable mast which allows the submarine to communicate at SHF and EHF while at periscope speeds and depths. The system shall be capable of simultaneous and individual link communications. Variable data rate, and transceiver capability to support future copernicus requirements.

PHASE I: Address concept designs, RF operational performance, and trade-off studies.

PHASE II: Design and build prototype for test and evaluation to demonstrate feasibility of the concepts.

PHASE III: Anticipate Navy sponsorship to transition into Submarine Communications Antenna Improvement Initiative.

N93-170 TITLE: Covert Submarine Battle Group Communications

CATEGORY: Research; Covert Submarine Communications, LPI

OBJECTIVE: Develop a covert, timely technique for communicating between the battle group and subsurface craft.

DESCRIPTION: Navy battle groups demand real time communications with all elements of the group, including any associated submarines. This requires an effective and timely communications system between surface and

subsurface ships. To ensure minimal degradation of submarine covertness, the system should have LPI and secure communication characteristics. The effort should also attempt to minimize constraints on the submarine's speed, depth, and course. The submarine also has the need to communicate with underwater swimmers.
Define and simulate selected techniques for communicating under water. Possible techniques include communications via ultraviolet wave lengths or via low frequency induction fields. The primary effort should emphasize ship/submarine communications, followed by the effort to provide communications with other platforms (e.g., underwater swimmers).

PHASE I: Address possible techniques, concept designs, signal and operational performance and trade-off studies.

PHASE II: Design and build engineering prototype for test and evaluation to demonstrate feasibility of the concepts.

PHASE III: Anticipate Navy sponsorship to transition into CSS.

N93-171 TITLE: High Dynamic Range Wide Band Receiver Front End

CATEGORY: Engineering Development; Digital Receivers, Digital Front End Signal Processing

OBJECTIVE: The development of a wide band front end module that converts radio frequency signals in the VLF to HF frequency range (3 KHz to 30 MHz) to a digital format. The module would interface with commercial available digital signal processor (DSP) modules to enable the quick design of new receive terminals.

DESCRIPTION: In Very Low Frequency (VLF) communications, the future progress possible in digital signal processing is now limited by the ability of receivers to convert analog signals to digital format over a large dynamic range (126 decibels or greater). Signal processing has been shown to be an effective method to compensate for a lack of transmitter power. Since it is desired to communicate over greater ranges from few sites, more signal processing is preferred.
Reconstruction of the communication signal in the presence of larger signals is also dependent on the amount of dynamic range available to the receiver. In cases where the communication signal is within a few dB of the noise floor of the receiver, signal reconstruction can be extremely difficult. The greater the dynamic range of the front end, the greater the interfering signals will have to be to disrupt communications.
Recent advances in digital signal processing have made it desirable to move the analog to digital conversion closer to the input of the receiver and to do less of the signal conditioning in the analog domain. A high dynamic range wide band receiver front end would permit the receiver to perform almost all of its signal processing in the digital domain and leave only the most rudimentary passband filters for the analog portion of the front end.

PHASE I: Phase I is a paper design of the receiver front end. Deliverables will include an analysis of intelligent gain control in the front end as well as the optimal way to maximize both bandwidth and dynamic range.

PHASE II: Phase II will be the construction of the receiver front end. Deliverables will include a working receiver front end and use, test, and maintenance manuals for the unit.

PHASE III: Anticipate Navy sponsorship to upgrade current VLF receive systems.

N93-172 TITLE: Artificial Intelligence (AI) for Command and Control

CATEGORY: Research; Machine Intelligence/Robotics

OBJECTIVE: Establish potential means of adding AI Battle Module optional modules on top of established Naval Tactical Command System-Afloat (NTCS-A), Operations Support System (OSS), and ASW Operations Center (ASWOC) architecture.

DESCRIPTION: NTCS-A is based on a federated architecture that has the Unified Build (UB) as its central component and has been adopted as the command, control, and intelligence support system for all echelons in the afloat environment. This same UB also forms the central component of the OSS at the CINC command centers and the ASWOC C3 Modernization program. Addition of an optional AI module to the established architecture at these

nodes would assist in solving complex battle management problems and serve to enhance the overall C^3I effectiveness of naval forces ashore and afloat.

PHASE I: Assess the architecture of NTCS-A, OSS and ASWOC focusing on the UB and the extent to which it has the capability to support optional AI-based applications for battle management and tactical decision aids. Identify any architectural modifications necessary to more fully support AI-based battle management and tactical decision aids. Establish an abstract process model for AI-based tactical decision aids mounted on top of UB.

PHASE II: Using the results of Phase I, develop a proof of concept demonstration for an AI-based battle management application or decision aid mounted as an optional application on top of the UB. This application should use the tactical scene description contained within the UB as the basis for its decision process, and provide proof of concept for at least one of the following issues: scene understanding, complex (non-linear) scene projection into the future, plan development, plan assessment, execution monitoring and replanning.

PHASE III: Depending on the results of Phases I and II, implement the AI-based Battle Management and decision aid module for NTCS-A, OSS, and ASWOC.

N93-173 TITLE: Battle Group Tactical Decision Aid and Training Tool

CATEGORY: Exploratory Development; Data Fusion

OBJECTIVE: The Battle Group Commander must plan for, monitor, and manage his air, surface, and sub-surface forces to counter a wide variety of threats and contingencies in theaters ranging from open-ocean to shallow water regional conflicts. The objective is to provide a Battle Group Management tool to allow the Battle Group Commander to efficiently assimilate and evaluate large amounts of dynamic multi-dimensional data, and to perform situation assessment and resource allocation functions in real time. This tool also may be used for shore based or shipboard training, and for rapid communication of "lessons learned" from other Battle Group Commanders around the world.

DESCRIPTION: This SBIR Topic will investigate, identify, implement and demonstrate a prototype tactical decision aid and training tool. Major system components may include: (a) a virtual reality Operator-Machine Interface (OMI), (b) C^3I sensor inputs and communication links, and (c) a database management system and real-time and historical Battle Group database. Virtual reality OMI technologies to be investigated will include simulated 3-d wide field of view color displays (e.g., dome projection, goggles, helmet-mounted displays), data/power gloves, audio and/or gesture- sensing command and control, image processing techniques, and other innovative virtual reality concepts. Recent developments in database management (such as object-oriented databases) will be reviewed, and Battle Group database requirements will be developed. Emergent computer/software/ database technologies will be investigated for hosting and driving the virtual reality OMI and the database management system. All components will interface with existing and/or emerging C^3I communications technologies.

PHASE I: Determine technical merit by surveying state-of-the-art virtual reality OMI technology, C^3I communication links, computer processors, and database management systems. Identify options having the greatest potential for use in a Battle Group environment. Conduct tradeoff analyses and recommend an optimum prototype design for Phase II. Deliver a Technical Report documenting all work performed and results.

PHASE II: Investigate integration and database requirements for Battle Group applications. Implement and test a prototype system. Demonstrate the prototype using realistic "Battle Group scenarios and data." Deliver the prototype system and data, together with documentation, to the Navy.

PHASE III: Pending a successful Phase II outcome, navy sponsorship will be provided to transition into the C^3I community.

N93-174 TITLE: Molecular Density Storage Disk

CATEGORY: Exploratory Development; Semiconductor Materials and Microelectronic Circuits

OBJECTIVE: To develop a prototype data storage disk and a read/write head capable of storing up to one tera-byte of data.

DESCRIPTION: The data storage requirements for Navy Command and Control Operation Centers are rapidly surpassing the current technology in data storage capabilities. Due to the substantial increase in data coming from new and refined sensors, the operation centers are faced with massive amounts of data tapes which must be maintained and stored on site for historical reference. This effort is costly as far as the procurement of tapes goes and it is quickly becoming a serious floor space problem. Additionally, many command centers are now being required to go mobile and transporting large volumes of storage tapes is not conducive to this effort. A module is needed which allows data to be stored on composite disks by controlled patterning of molecules on multiple layers of the disk. This technique allows for a 4:1 reduction in size and a 1000:1 increase in data storage. A second to third module of the storage system that does not currently exist is the read/write laser head and the radiation hardened Application Specific Integrated circuits (ASICs) used for supporting the control and read/write/erase functions of the head. By using available disk technology and developing an efficient laser head device and

controlling integrated circuit, an extremely useful system can be produced which will benefit both the military and commercial industry.

PHASE I: Provide a modular engineering design concept to include a steerable laser head for writing and reading data onto the disk, disk material make-up and overall system design.

PHASE II: Provide demonstration modules which implement the elements of Phase I.

PHASE III: The results of this development will benefit DoD sites worldwide as well as the commercial sector.

N93-175 TITLE: SHF Array Antenna

CATEGORY: Exploratory Development; Signal Processing

OBJECTIVE: To develop a stacked phased array SHF antenna which is easily transportable, easily deployable and has no moving components.

DESCRIPTION: The SHF antenna designs of today are cumbersome, mechanically controlled and poorly suited for mobile applications. Additionally, a single antenna must be rotated in order to communicate with different suers in varying locations. A stacked, phased array SHF antenna can handle multiple users in varying locations (without rotating) and at the same time provide an increase in signal strength gain. In order to meet the requirements of rapid deployment units, the antenna must be collapsible and quickly deployable.

PHASE I: Develop the hardware design and materials list which meets the stated objective.

PHASE II: Provide a demonstration prototype which can meet the requirements listed in the description section.

PHASE III: Results of this tasking will lead to a final design which will support requirements of DoD command and control nodes.

N93-176 TITLE: C^3 Computer Assisted Communications

CATEGORY: Research; Signal Processing

OBJECTIVE: Design, model and prototype a computer-assisted, user-friendly, multi-function communications control system which optimizes the use of all available media (point-to-point and/or the entire radiated frequency (RF) spectrum) to establish virtual voice, data, facsimile or imagery connectivity between users.

DESCRIPTION: Within the context of the Copernicus command, control, communications, computers and intelligence (C4I) architecture, CNO has mandated that communications connectivity be "virtual" (e.g., specific RF or point-to-point media should be invisible to the user; the ability of users to "pull" information from available sources in a timely manner is the principal criterion). An innovative approach is required to design and prototype a computer-assisted communications control system which meets the following criteria: small, lightweight, mobile, with minimum input power requirements; modular "plug-in" board components of VME and FutureBus design housed in standard chassis, which run applications software under DOS and UNIX, and have the capability to download and process software and data transmitted from a remote site. (Boards must be compatible with, and compatible in power to, DTC-2, TAC-3 and 486 PC computers); features high-speed, fiber optic 4X4 to 16X16 port photonic switch connectivity to enable operation of remote, unmanned communications sites; includes >64KB digital packet switching in an asynchronous transfer mode (ATM) network to enable broadband services (such as video teleconferencing); features a user-friendly workstation wherein voice, data, facsimile or video can be selected; data compression, encryption, selection of wideband or narrowband; and provide an aggregate output to allow for bandwidth on demand.

PHASE I: Provide potential designs, trade-off analyses, and where possible, demonstrations of proposed technology.

PHASE II: Develop a working model of the computer-assisted communications system. A detailed comparison with presently available equipment is essential.

PHASE III: Develop a prototype of the system. Anticipate significant DOD interest upon successful prototype testing.

N93-177 TITLE: Passive Remote Sensing of Meteorological Parameters

CATEGORY: Exploratory Development; Passive Sensors

OBJECTIVE: To develop surface based passive remote sensing techniques to obtain vertical profiles of meteorological parameters.

DESCRIPTION: Meteorological support is a vital requirement for the planning and execution of virtually every aspect of Naval warfare. This support is often critically dependent on the ability to accurately measure local atmospheric parameters in real time. These parameters include inter alia, temperature, wind speed and direction, humidity and aerosol content. Currently, balloon or rocket borne sounders are used to obtain data remotely, and LIDAR techniques are under development to acquire vertical profiles of these parameters. The disadvantage of these active systems is that they radiate electromagnetic or electro-optic energy subject to enemy detection. In addition, personnel safety and space requirements may be important issues, especially in shipboard environments. Passive surface based sensors are an attractive potential alternative.
Innovative new technologies are sought which can provide a capability to passively measure meteorological parameters in both marine and overland environments. Proposed devices must be able to provide vertical meteorological parameters up to several thousand meters altitude with a resolution of 100 meters or better. Systems should be capable of day and night operations in a wide range of weather conditions.

PHASE I: This six month effort should produce an evaluation of technologies which may lead to a ground based passive remote sensing capability to measure vertical profiles of at least one meteorological parameter.

PHASE II: A two year effort to complete development of the proposed instrument, including a performance demonstration which will confirm the accuracy and capability expected from the fielded system.

PHASE III: A Phase III effort is planned.

NAVAL SUPPLY SYSTEMS COMMAND

N93-178 TITLE: Commercial Pallets for Cargo Transfer at Sea

CATEGORY: Engineering Development; Weapons System Environment

OBJECTIVE: Eliminate need for special "winged" pallets in CONNECTIVE underway replenishment of weapons systems items at sea for cost and operational gains.

DESCRIPTION: When transferring weapons systems spare/replacement parts, consumables, and other items from a replenishment ship to another ship, the two ships steam alongside on parallel courses while linked with a cargo transfer rig by which unitized pallet loads are transferred. Pallets are suspended from the rig with slings which hook under protruding ends of top boards or "wings" of the pallets. To date, no other means of lifting the pallets has been devised; this single mandatory requirement results in the entire military establishment using special "winged pallets" to accommodate the possibility that any particular pallet load will eventually need to be transferred at sea by the underway replenishment method described above. Alternative means using standard commercial pallets must be developed that are at least as fast as the current method, and if possible, safer. Work will include providing means for continuing use of "winged" pallets until phased out of use and for accommodation of the several types of commercial pallets now in use and being proposed and/or developed; this includes accommodation of the several types of commercial pallets currently being considered/proposed for use as a national standard default pallet. These references can be obtained from NAVSUP: NWP-14D, "Underway Replenishment at Sea"; NAVSEA OP2173 Volumes 1 and 2, "Approved Handling Equipment for Weapons and Explosives".

PHASE I: Become knowledgable about current connective underway replenishment procedures and all types of pallets now in use or anticipated for use, including site visits to one East Coast fleet logistics base, and other means, as appropriate. Submit a report on proposed feasible alternatives to accomplish the desired improvements.

PHASE II: Navy selection of one of the proposed alternatives for development of a complete engineering study for one of several types of underway replenishment rig configurations. The work will include detailed drawings of the proposed design complete with data on strength testing and design computations. Fabricate and test the device on the selected type of rig configuration during actual replenishment at sea or at a land based test site.

PHASE III: Fabricate several devices for each of the several types of underway replenishment rig configurations. These devices will then be tested at sea during actual underway replenishment. Make modifications to fabricated devices as necessary to ensure that a final design will achieve the desired objective of this research. The work will include development and submission of 100 percent design drawings and specifications for follow-on procurement of transfer devices for all replenishment ships of the Navy.

N93-179 TITLE: Streamlined Requisitioning of Ammunition

This topic is CANCELLED.

N93-180 TITLE: Computer Aided Prediction Tool for Parts Obsolescence Management

CATEGORY: Exploratory Development; Computers

OBJECTIVE: To develop, demonstrate and test a Navy wide relational database for prediction of parts obsolescence management.

DESCRIPTION: Develop or enhance relational database software, on commercially available computer hardware, to provide the Navy a predictive tool that will allow for the planning, management and cost avoidance in the area of electronic and mechanical parts obsolescence. Current systems exist that provide limited predictive capabilities in a specific electronic area (microcircuits). Obsolescence prediction tool survey Analysis, of 20 August 1992 is available upon request via the NAVSUP point of contact. Those systems should be research for feasibility, and effectiveness, and integrated into a comprehensive Navy prediction tool. Attributes of the system should include at a minimum; (1) Break-out of the components by technology, function, manufacturer, packaging requirements, suppliers; (2) Identification of alternate sources; (3) Depict or minimize the use of single source vendors; (4) Provide an "alert notification" or access to an alert notification system, (5) Has or can integrate or develop a complete list of electronic and mechanical components used in U.S. military weapons systems; (6) The system should be remotely accessible through electronic or by magnetic tape; (7) The system is to be "user friendly".

PHASE I: Explore the feasibility of a Navy wide integrated predictive tool. Make an assessment of applicable existing predictive tools and develop predictive models where currently not available to cover the wide spectrum of electronic and mechanical parts. Develop and demonstrate a "laboratory" model of this prediction system. Prepare a final report that documents all Phase I efforts and criteria for the development of the prototype system. Travel to various Navy Weapon Center Divisions (i.e., Keyport, WA, Crane Indiana) and commercial vendors (east and west coast) will be required.

PHASE II: Develop, test and evaluate an obsolescence tool which has the capabilities described above in Phase I, for use in Navy Headquarters facilities and field activities. Preparation of a documentation package, a users guide and formal training to several Navy activities on the system will be required deliverables.

PHASE III: If Phase II is successful, Phase III will include additional multiple users and follow-on training.

NAVAL CIVIL ENGINEERING LABORATORY

N93-181 TITLE: Novel Methods of Paint Removal from Wood, Concrete or Steel Substrates

CATEGORY: Exploratory Development; Composite Materials/Simulation and Modeling

OBJECTIVE: Develop a method of removing existing paint systems that would produce minimal debris and dust, but still have moderate to high productivity.

DESCRIPTION: Current methods for the removal of existing paint
systems either produce large amounts of dust and waste or have a low production rate. With the development of strict regulations governing air pollution and disposal of wastes, many existing paint removal practices will no longer be cost effective. Generation of dust and hazardous waste is also a major health and safety concern in the removal of lead-based paint. A technique is needed that would effectively remove paint from various substrates while producing the least amount of debris and dust. (funding for this Phase I topic will not exceed $50,000)

PHASE I: A detailed report shall be produced which describes the method and provides sufficient scientific and engineering.
substantiate its feasibility. Technologies identified must show the potential to be more efficient than current industry practices in terms of debris, dust and hazardous materials generated and the rate of removal. A test plan shall also be developed for demonstrating the technique in Phase II.

PHASE II: Develop, test and evaluate the method identified in Phase I. The candidate method shall demonstrate the capability of
removing paint from wood, steel or concrete in a manner which produces less dust and debris than existing paint removal techniques. A moderate to high rate of removal shall also be maintained.

PHASE III: Phase III effort is anticipated to take advantage of the results of Phase I and Phase II through the commercial sector.

N93-182 TITLE: Repair of Reinforced Concrete Piers

CATEGORY: Exploratory Development; Composite Materials

OBJECTIVE: Identify failure mechanisms, methods, and materials to increase longevity of sub-structure repairs to reinforced concrete structures to 20 years or more.

DESCRIPTION: Corrosion of the reinforcement is the most common form of degradation. The underside of existing structures are often contaminated with chloride ion and moisture to a severe level resulting in intense local corrosion cells. The most severe problem occurs on the underside of the deck, pile caps, beams and piles in the splash zone. The top of the deck is often not damaged or contaminated to the threshold, hence macro-cell corrosion is also likely. Current repair methods to remove and replace debonded concrete have a life expectancy of 2-20 years. NCEL has identified four topics for investigation: cathodic protection systems, mechanisms of de-bonding, maximum allowable shrinkage of repair materials and quality control. (funding for this Phase I topic will not exceed $50,000)

PHASE I:

A: Evaluate the applicability of adopting or adapting current cathodic protection systems used on highway bridges to the underside of Navy pier decks over the ocean. Both anodic and impressed current systems shall be considered. Design an investigation to establish the feasibility of constructing an effective and durable cathodic protection system for substructure application.

B: Propose a mathematically model to predict life expectancy of a restrained cementitous repair material as a function of shrinkage, temperature and creep. Life expectancy is defined as the time before stresses at the bond results in debonding. Design an experiment to validate the model.

C: Propose quality control methods which will increase longevity of sub-structure repairs that are applicable to Navy contract and inspection procedures. Design a task to develop the proposed methods.

PHASE II:

A: Conduct an investigation to establish the feasibility of constructing an effective and durable cathodic protection system for substructure application.

B: Verify the mathematically model to predict life expectancy of a restrained cementitous repair material as a function of shrinkage, temperature and creep in laboratory tests.

C: Develop quality control methods which will increase longevity of repairs to a 20 year life.

PHASE III: Further development and demonstration of performance is required but is function of available Navy funding.

NAVY PERSONNEL RESEARCH AND DEVELOPMENT CENTER (NPRDC)

N93-183 TITLE: Hypermedia for Training

CATEGORY: Exploratory Development; Training

OBJECTIVE: To explore the use of hypermedia to increase the efficiency and effectiveness of Navy training.

DESCRIPTION: Hypermedia is a technology for organizing discrete chunks of information in a non-technical manner. A chunk of information might be represented as text, sound, pictures, animated graphics, or video. Any chunk of information can be linked to any other within a hypermedia application. Hypermedia is a versatile software tool because it can manage multimedia, is easy to use, and is flexible. Given its versatility, hypermedia may have potential as an instructional delivery system particularly in instances where an abundance of declarative information is required to be learned or where learners are required to link information in a meaningful way. However, the use of hypermedia as an instructional delivery system requires more theoretical research and technical development (Park, 1991). Critical areas of hypermedia research include the effects of learner control, form of information presentation, and organization of knowledge base. (funding for this Phase I will not exceed $50,000)

PHASE I: Explore the feasibility of using hypermedia as an instructional delivery system. Investigate its potential in learner control, form of information presentation, and organization of knowledge base.

PHASE II: Develop a software program which can be used to create experimental hypermedia-based training. Employ this software to create training for the declarative knowledge requirements of the General Electric LM2500 Gas Turbine Engine. Empirically evaluate the effectiveness of the training.

PHASE III: Pursue the development of a generic software which enables the design and development of hypermedia training.

N93-184 TITLE: Identification of Knowledge Structures Underlying a Task Process Model

CATEGORY: Exploratory Development; Training

OBJECTIVE: To develop a method for identifying knowledge structures that underlie the procedures for performing a task.

DESCRIPTION: One type of model that can be developed for a particular job or task is a process model in the form of a flow chart. However, this approach concentrates on procedures as opposed to knowledge. Once the process model is constructed, it could be enhanced by identifying underlying knowledge structures that are related to critical procedures in the process model. Several methods exist for knowledge elicitation; for this effort, the starting points for developing the knowledge structures are critical procedures in the process flow model. (funding for this Phase I will not exceed $50,000)

PHASE I: Develop a method for identifying knowledge structures underlying a process model of a particular task or job. Both the acquisition of the knowledge structures and their representation should be specified. The method should be as parsimonious as possible and relatively easy to apply by someone who is not a knowledge engineer.

PHASE II: The method developed in Phase I will be applied to two content domains and evaluated. Two forms of evaluation would include the method for acquiring the knowledge and the form of the knowledge structure itself.

PHASE III: A generic form of the model will be explored for development as a software package.

N93-185 TITLE: Software Development for Linking Cognitive Styles with Instructional Strategies

CATEGORY: Exploratory Development; Training

OBJECTIVE: Develop methods to assess learners' possession of cognitive styles and their relationship to performance; investigate inclusion of cognitive styles as a component of a student model in an intelligent tutoring system.

DESCRIPTION: Cognitive style, as a component of learner aptitude, impacts learning and operator performance. Even though specifications for tailoring instructional treatments to aptitudes have been known for some time, to date the differences among learner aptitudes could not be handled effectively or practically in the military training environment. Now, with the advent of intelligent tutoring systems, and sophisticated software potential, we may have the vehicle to address the role of cognitive styles in learning and performance. (funding for this Phase I will not exceed $50,000)

PHASE I: Examine the inclusion of cognitive styles into a dynamic student model, and the tailoring of instruction to those aptitudes in an effort to decrease training time and increase skill and knowledge retention and performance; explore the feasibility of developing a means to assess cognitive style.

PHASE II: Incorporate cognitive style into a dynamic learning model which matches instructional strategies to
individual cognitive style. Development cognitive style
assessment tools.

PHASE III: Explore the adaptability of the cognitive style/instructional strategy model to various computer systems.

N93-186 TITLE: Modeling Electronic Warfare (EW) Operator Performance

CATEGORY: Exploratory Development; Training

OBJECTIVE: To develop a model of EW operator performance that could be used for training/diagnostic purposes.

DESCRIPTION: EW operators require refresher training at regular intervals to maintain their skills. Currently, most refresher training is provided on a scheduled periodic basis, without regard for the actual status of the operator's skill level. The training EW operators receive should focus on the areas that will show the most significant gains in overall performance/effectiveness, as well as the areas that are most likely to degrade during routine operations. The purpose of this effort is to develop a model of EW operator performance that could be used to identify the most beneficial training, and could also predict the areas most likely to become degraded. (funding for this Phase I will not exceed $50,000)

PHASE I: Analyze available modeling software and identify the most appropriate for this application. Develop a model of EW operator performance, specifying operator tasks and decision branches to at least three levels, using the identified software.

PHASE II: Obtain the performance data necessary to validate the model developed in Phase I.

N93-187 TITLE: New Techniques to Assess Learning Retention

CATEGORY: Exploratory Development; Training

OBJECTIVE: Develop techniques to assess learning that are superior to traditional pencil and paper tests.

DESCRIPTION: Many Navy jobs are very complex. It is often very difficult to determine when a trainee is really competent to perform on-the-job. Traditionally, trainees are judged to be ready for graduation from a training course when coursework is complete if the average grade from periodic testing are above a predetermined criterion level. Grades are most often determined through paper and pencil testing, although performance on simulated tasks may also be graded. This system is far from perfect because it is based upon the assumption that memory for facts and figures is correlated with performance. Indeed, memory is correlated with performance, but the correlation for any particular job may be rather low. In the classroom environment, performance testing may not be possible because of resource, technological, and safety restrictions. Alternative methods to estimate learning and retention of complex skills and knowledge could improve assessment in many job specialties. (funding for this Phase I will not exceed $50,000)

Phase I: It is known that learning results in long-term changes in the brain which can possibly be assessed using modern neuroscience techniques. One measure that has been shown to reflect changes in the brain structure and function is the event-related potential (ERP). In the standard paradigm, individuals are exposed to a stimulus that is presumed to be related to the function being measured. Brain electrical or magnetic activity is recorded just prior to, and following, the stimulus. The shape of the waveform that is recorded is affected by the perceptual, cognitive, and motor processes associated with the task. Previous research has suggested that semantic knowledge can be reliably assessed using these techniques. The purpose of this research would be to identify and develop specific ERP techniques to assess knowledge and skill, and demonstrate that these techniques can reliably assess knowledge and skill for a subset of tasks similar to a specific Navy job.

Phase II: Once the techniques have been developed and assessed, it will be necessary to evaluate their usefulness in a Navy population. This would involve trainees in a technical training course. Initially, the work would involve the selection of the skill and knowledge domain to be used in the evaluation. It is anticipated that performance tests would have to be developed if they do not already exist. Once the domain is selected, trainees would be evaluated periodically during training.

PHASE III: Commercialization to other government and private sector areas.

N93-188 TITLE: Signal Processor for Operational Biopsychometric Assessment

CATEGORY: Exploratory Development; Simulation

OBJECTIVE: Design and develop a compact, rugged, and portable signal processing system for operational recording, storage, and real-time processing of brain electrophysiological measures.

DESCRIPTION: The combat systems of the future will take advantage of adaptive algorithms for real-time enhancement of human operator performance. Depending on the inferred cognitive state of the operator, the system will modify its characteristics---interface, workload, level of automation---so as to maximize the combat effectiveness of the operator. Research has shown that biopsychometric techniques based on EEG and event-related potentials (ERP) provide information about the cognitive state of human operators in laboratory simulations of Navy combat systems. EEG measures provide indices of alertness in vigilance tasks such as sonar monitoring. ERP measures index operator workload and can predict performance in resource-limited tasks such as electronic warfare. Other research has shown that biopsychometric techniques may also allow for real-time monitoring of cognitive state in aviators. In addition, biopsychometric methods will have impact on simulator-based training, by adapting the training protocol to the current ability of the trainee. (funding for this Phase I will not exceed $50,000)

PHASE I: Implementation of biopsychometric methods will require a new generation of hardware and software for data acquisition and processing. In Phase I, studies and designs are invited for compact, rugged, and portable systems for operational EEG data acquisition and signal processing. Such systems must address three fundamental technical problems: (1) Standard electrode assemblies which are minimally obtrusive, easily attached in a few minutes by operational personnel, require no adhesives or special electrolyte compounds, and provide adequate signal-to-noise ratio for recording the EEG, (2) real-time signal processing capability which allows for analog amplification, anti-alias and notch filtering, as well as for digital processing including ensemble averaging, digital filtering, spectral analyses, multiresolution analyses or sub-band coding, and wavelet transforms. The system must be able to apply such algorithms to multi-electrode EEG data obtained at data rates of about 10K samples per second, obtain results, and supply them to the system for use in adaptive algorithms within a 30-second window of acquisition time, and (3) large storage capability suitable for recording for several hours of unattended operation at data rates of 10,000 samples per second or approximately 300 megabytes. Such storage should be resistant to operational hazards such as electrical or magnetic fields encountered on ships and aircraft.

PHASE II: Prototype signal acquisition/processing systems will be developed and evaluated in candidate Navy operational tasks including sub-surface ASW and surface EW. Navy laboratories using biopsychometric technology will perform the evaluations and provide feedback to designers as required. A final design will be targeted for advanced development and procurement.

NAVAL AIR SYSTEMS COMMAND

N93-189 TITLE: Passive vs Active Fly-By-Wire/Fly-By-Light (FBW/FBL) Electronic Flight Controller

CATEGORY: Engineering Development

OBJECTIVE: To develop an acceptable architecture, proof -of-concept, prototype design and flight test evidence leading to a production configuration for a replacement for a tilt rotor aircraft cyclic stick controller and foot pedal combination.

DESCRIPTION: A side-arm or center stick electronic controller will reduce the weight of the V-22 aircraft and improve aircraft handling qualities. A passive controller will provide significantly greater weight reduction over an active system. However, an active controller may provide better aircraft handling qualities than a passive system but with much greater complexity and size.

PHASE I: A study will determine which combination of side-arm vs. center stick and passive vs. active configuration of electronic controllers will provide the best configuration and weight reduction standpoint. A detailed and comprehensive survey of all existing military and commercial fixed- and rotary-wing aircraft utilizing center-stick and/or side-arm controllers will be included.

PHASE II: A prototype system will be developed and laboratory tested in the V-22 FCSIR and flight tested as a back-up system to the cyclic stick mechanical controller and foot pedals currently on the V-22.

PHASE III: This topic has the potential for transition to PHASE III via linkage between the small business and the V-22 prime contractor and/or component suppliers.

N93-190 TITLE: Generalized Study of Avionics Architecture/Bus

This topic is CANCELLED.

N93-191 TITLE: High-Speed Opto-Electronic Processing

CATEGORY: Engineering Development; Parallel Computer Architecture

OBJECTIVE: To develop an integrated approach to opto-electronic devices and systems for implementation of high-speed processing architecture. State-of-the-art technology should be used to reduce power, size, and weight, and greatly increase the speed of processors used on-board navy advanced tactical aircraft such as the V-22. The process is intended to improve the computing capabilities for command, control, and communications of tactical aircraft and space-based assets.

DESCRIPTION: Advancing optical technology is producing an assortment of devices and system components suitable for interconnecting electronic chips which can significantly impact the speed and compactness of processors. Examples are semiconductor modulator and microlaser devices, micro-optic, free-space and waveguide interconnection media. Integration of opto-electronic, electronic, and micro-optic components on a substrate and the optical interconnection of multichip modules thereof is highly desired.

PHASE I: The result of the PHASE I study will be a design for configurations of electronic, and classical optical components which are mutually compatible and can be implemented into an opto-electronic processing architecture.

PHASE II: The results of this effort will produce a working prototype opto-electronic integrated circuit suitable for opto-electronic processing architectures.

PHASE III: This topic has the potential for transition to PHASE III via linkage between the small business and the V-22 prime contractor and/or component suppliers.

N93-192 TITLE: Avionics Architecture/Data Bus Configuration

CATEGORY: Engineering Development; Parallel Computer Architecture

OBJECTIVE: Evaluate the contributions of avionics architecture/data bus configuration to data latency.

DESCRIPTION: The Navy must optimize avionics architectures/data bus configurations so that data latency is limited and system performance is maximized.

PHASE I: This effort will provide recommendations on methodologies and techniques that can be implemented to minimize data latency for single-level, multi-level, and hierarchical data bus architectures. Factors to be considered will include gap/response/interrupt times, processing algorithms, synchronization, message type/ordering/framing, and data formatting. In addition, adjustments and cost to existing systems required will be identified to attain optimum architecture.

PHASE II: A breadboard control and display system will be built and appropriate software developed using simulated avionics interfaces and demonstrated in a mature military aircraft systems integration lab (SIL).

PHASE III: This topic has the potential for transition to PHASE III via linkage between the small business and the V-22 prime contractor and/or component suppliers.

N93-193 TITLE: Tilt Rotor Aircraft Portable Landing Aid System

CATEGORY: Advanced Development; Weapon System Environment

OBJECTIVE: To develop a conceptual design for a portable landing aid system which would take maximum advantage of tiltrotor aircraft VERTOL/VSTOL capabilities.

DESCRIPTION: The development of the MV-22 tiltrotor aircraft holds the promise of performance not previously achievable with rotary wing aircraft. Increased range and speed, enhanced load capacities, and a much reduced noise profile (blade slap) will allow the development of significantly more ambitious and aggressive SOF mission profiles. Covert, all weather personnel/equipment insertion and extraction capabilities would be greatly enhanced by the development of a low probability of intercept (LPI), portable landing aid system (PLAS). The system design should take full advantage of MV-22 VERTOL/VSTOL capabilities and provide precision guidance to touchdown or hover at/over a desired ground point.

PHASE I: PHASE I study would include the following elements:

a) Review of projected V-22 mission profiles to determine PLAS capture window requirements.

b) Review of V-22 VERTOL/VSTOL approach and landing profiles to determine PLAS operating windows (i.e., +/-X degrees in azimuth and elevation) and/or modes (i.e., flat approach, steep approach, landing, or hover).

c) Determine ability of air crew to track precision landing aid with V-22 to define PLAS glide path and glide slope resolution requirements for the V-22 approach profiles identified above.

d) Identify PLAS power and antenna pattern requirements and assess LPI characteristics.

e) Develop conceptual PLAS design.

PHASE II: PHASE II will involve the development, test, and demonstration of a prototype PLAS system.

PHASE III: This topic has the potential for transition to PHASE III via linkage between the small business and the V-22 prime contractor and/or component suppliers.

N93-194 TITLE: Expeditionary Airfield Soil Stabilization

CATEGORY: Exploratory Development; Weapon System Environment

OBJECTIVE: Develop and evaluate an environmentally safe soil stabilization compound which will eliminate the effects of soil micro-fod on turbine engines and the leading edges of prop/rotor blades.

DESCRIPTION: Need exists for stabilizing the soil in the immediate vicinity of where AM-2 matting is laid at Expeditionary Airfields due to the effects of soil micro-fod. During Desert Shield/Desert Storm, numerous cases of pre-mature turbine engine degradation and prop/rotor blade erosion were documented due to the effects of soil micro-fod. Upon IOC of the MV-22, it is considered that this problem will be further exacerbated due to the MV-22's increased rotor downwash. Based on documented cases, the effects of soil micro-fod on the MV-22's engines and prop/rotor system will substantially reduce the service life of these components.

PHASE I: Explore and evaluate available soil stabilization compounds based on effectiveness, cost/unit, method of application, shelf life stability, and environmental compatibility.

PHASE II: Test available compounds at an Expeditionary Airfield in order to determine suitability.

PHASE III: The topic has the potential for transition to PHASE III via linkage between the small business and the V-22 prime contractor and/or component suppliers.

N93-195 TITLE: Expeditionary Lighting

CATEGORY: Exploratory Development; Weapon System Environment

OBJECTIVE: Develop and evaluate a light-weight, expeditionary lighting system, comparable to the GAIL light system, that will facilitate day/night unaided and Night Vision Goggle (NVG)/ Forward Looking Infrared Radar (FLIR) approaches to landing. This system shall include a NVG/FLIR compatible VASI.

DESCRIPTION: Current expeditionary lighting is outdated, unreliable, and is not compatible with NVG/FLIR systems. Consequently, aircraft forward basing can not be effectively executed with a comfortable margin of safety. With a suitable and compatible lighting system, the MV-22 would be able to operate from forward expeditionary sites with an increased margin of safety.

PHASE I: Explore and evaluate available lighting systems based on effectiveness, cost/unit, compatibility with night systems NVG/FLIR), cube, weight, deployability, and commonality with other services' lighting systems.

PHASE II: Test available lighting systems at an Expeditionary Airfield in order to determine suitability.

PHASE III: The topic has the potential for transition to PHASE III via linkage between the small business and V-22 prime contractor and/or component suppliers.

N93-196 TITLE: Interactive Embedded Training System for Military and Commercial Aircraft

CATEGORY: Advanced Development; Simulation and Modeling and Software Producibility

OBJECTIVE: To develop a method for constructing interactive on-board, artificially intelligent training system for pilot and crew tasks that is portable, robust, high-fidelity, and constructed of reusable components. The benefits of this effort will include (1) increases in a pilots situational awareness and overall system knowledge and (2) a software and hardware infrastructure that can integrated with advanced on-board mission processors for developing health and usage monitoring systems.

DESCRIPTION: Currently, all aircraft flight system and performance analyses are conducted using airworthy qualified flight manuals. As aircraft and their systems become more complicated, the manuals become more cumbersome and are difficult to use in a classroom environment. Recently, many manuals have been reduced to electronic flight manuals (data files) which can be read and manipulated by desktop or portable computer systems. By embedding intelligent training and flight software within these electronic flight manuals, it is possible to develop a comprehensive interactive learning aid complete with instructional lessons, multi-media video and sound systems, and network capabilities.

The production of such portable, high fidelity, intelligent training systems requires the development of object oriented dynamic link libraries, object linking, and embedding modules. This technology permits easy access to relational databases while presenting video lectures, comprehension testing, help commands, and tutorials. It is anticipated that a Windows-compatible environment will make it possible to develop a generic embedded software training tool that an be used in a wide variety of military and commercial aircraft.

A key feature to the success of wide scale production of such training systems is the development of generic aircraft flight prediction algorithms that which significantly reduce data storage and processor requirements. Advanced mathematical techniques will be merged with theory and flight test data to develop a continuous equation set which completely defines the aircraft operating state.

PHASE I: The primary activities during Phase I will be (1) the development of systems requirements for the portable, intelligent, multi-media training systems and (2) the construction of the generic aircraft flight prediction algorithms. The contractor will work with NAVAIR to identify target aircraft and training scenarios of importance to the NAVAIR mission. The deliverable for Phase I will be a technical report specifying alternative systems architectures with recommendations and the generic aircraft flight prediction algorithms.

PHASE II: During Phase II the contractor will produce a prototype training system based on the selected architecture identified during Phase I. The prototype will use the generic aircraft flight prediction algorithms developed during Phase I and will train pilots and crew for an aircraft central to the mission of NAVAIR.

PHASE III: Navy funding is anticipated for Phase III activities.

N93-197 TITLE: Computer-Based Training For Corrosion Control

CATEGORY: Research; Computers

OBJECTIVE: Develop and demonstrate CBT interactive course (ICW) for basic corrosion control training for use on stand alone IBM compatible PC computers for all military services.

DESCRIPTION: This requirement is for the utilization of state-of-the-art development in ICW technology specified in DoD specifications and standards to instruct and train personnel in the recognition, correction, treatment, and prevention of corrosion. Appropriate areas for consideration might include, but are not limited to: aircraft, vehicles, ships, and electronic equipments.

PHASE I: Identify training package concepts, methodology, and tools required by MIL-HDBK-284-1 and MIL-STD-1379D by conducting an evaluation of existing commercial authoring packages and/or developing a limited customized software package.

PHASE II: Purchase and test computer software identified in Phase I and develop, demonstrate, and deliver prototype corrosion control training models using these software packages.

PHASE III: Some parts of this program may have commercial use.

N93-198 TITLE: Development of a Direct Manipulation Interface for Real-Time Demonstration of Simulated Flight Training Scenarios

CATEGORY: Exploratory Development; Simulation and Modeling and Machine Intelligence

OBJECTIVE: The objective of this project is to develop a Direct Manipulation Interface that will allow trainers to configure, in real time, training scenarios for individual and crew training. Benefits include (1) extremely rapid configuration of training scenarios and (2) the ability to reconfigure training in real time.

DESCRIPTION: Design of individualized training exercises for pilots, missile control crews, and the like is a very costly, and time consuming activity which requires the interaction of many people, including trainers, programmers, and engineers. In order to be able to respond more quickly to the training needs of individuals, it will be necessary to provide trainers with a way to quickly build training scenarios without the assistance of programmers, engineers, etc.

This project will focus on the development of the requirements and specifications for a virtual reality based Direct Manipulation Interface (DMI) authoring system for real-time construction of flight training scenarios. The DMI should permit a trainer to simply reach into the virtual reality to configure training scenarios. Behind the scenes program generation software will interpret the trainer's design, search a library of reusable software and hardware components, and configure the training scenario automatically in a matter of seconds or minutes. In addition, the DMI should permit trainers to alter training scenarios as they unfold in real time. Proposals with NAVAIR user endorsements will be given special considerations. This project will have three phases.

PHASE I: During Phase I, the contractor will perform analyses of a subset of the domain of training scenarios that is of interest to specific branches of NAVAIR. This phase will identify (1) the hardware and software components that will have to be specified to develop the libraries of reusable components, (2) develop a description of a virtual reality based DMI that will allow trainers to develop training scenarios in real time, and the hardware and software specifications for the DMI will be given. The deliverables for Phase I will be a written report covering (1) and (2) above and a plan for Phase II.

PHASE II: During Phase II, the contractor will develop a significant prototype virtual reality based DMI for constructing training scenarios. The selection of the domains of the prototype will be performed in conjunction with NAVAIR. The prototype will handle two training domains. The deliverables for Phase II are (1) the prototype and (2) a demonstration of commitment to produce the full scale tool.

PHASE III: This is commercialization phase. A fully operational virtual reality based DMI for constructing training scenarios will be developed. NAVAIR may be interested in becoming a beta test site to provide government/user feedback into the commercial market.

N93-199 TITLE: Alternative Motion Systems for Interactive Flight Simulation Systems

CATEGORY: Exploratory Research; Simulation and Modeling

OBJECTIVE: To investigate new motion base technology in order to determine a low cost motion simulation alternative for interactive simulator systems.

DESCRIPTION: Today's military flight simulation systems require a high fidelity not only in the visual system, but also in the motion system as well. Where customers of visual systems have enjoyed the benefits of falling prices and higher technology, typical in today's computer market, the same cannot be said for the motion systems market. The traditional motion system requires a large reaction mass in addition to a complex and massive hydraulic system . In order to induce realistic sensations of motion to match the ever improving visual simulation, extremely large investments must be made by the customer, not only for the motion system itself, but also in the military construction associated with housing such a sizable device. In addition to the extremely high cost of procurement, the traditional motion base system also carries with it, high life cycle maintenance cost. With ever decreasing DoD budgets, it is imperative that more cost effective solutions be found.
There is now evidence in the commercial industry of potential cost effective alternatives to traditional motion systems. Recent advances in hardware and software technology warrant the assessment of alternative motion systems technology to provide innovative , cost effective solutions to DoD as a whole.

PHASE I: During Phase I the contractor will investigate the feasibility of alternative motion base technology as it is applicable to DoD (Navy and Marine) real world flight simulators and produce a final technical report.

PHASE II: During Phase II, the contractor will design and develop a prototype system, based on the requirements specified in the efforts of Phase I.

PHASE III: Upon successful completion of Phase II, Navy funding is anticipated for limited production of the prototype .

N93-200 TITLE: Risk Reduction Management System

CATEGORY: Advanced Development; Simulation and Modelling

OBJECTIVE: Provide a high level management tool to enable the Program Office to use the results of technical analyses to manage program risks.

DESCRIPTION: Provide a system to consolidate results from the following into an interactive data base: environmental analyses, system operational analyses, threat inputs and tactical modelling. The system should define formats for the basic analysis results and provide capability for the program office to explore "what if" questions not necessarily addressed in the underlying analysis. This system will be used to manage program risks in the Program Office.

PHASE I: Identify hardware and software available to develop a risk management system and provide a development plan for building the system including a preliminary description of the architecture you would use to develop the system. The data consolidation is to be accomplished at Navy laboratories, and the risk management tool is to be installed in the project office.

PHASE II: Build and test a prototype of the risk management system defined in Phase I.

PHASE III: Implement lessons learned in Phases I and II and install operational system in the Project Office (PMA-264) and in one Navy laboratory (laboratory to be named by the Project office).

N93-201 TITLE: JTIDS/MIDS Displays Optimization

CATEGORY: Engineering Development

OBJECTIVE: The objective is to determine the optimum display size and information type for the pilot using JTIDS/MIDS.

DESCRIPTION: JTIDS/MIDS provides the means for a fighter aircraft to transmit/receive a great deal of information to/from other fighters and Command and Control (CC) platforms. However the amount of information available to the operators can be overwhelming. The physical display size and the shape, intensity, color and size of the symbols are important parameters in the optimization of the operator/machine interface during high data rate environments.

PHASE I: The study will research, model, and document answers to the following questions: (1) What is the optimal physical display size for a system like JTIDS/MIDS?, (2) What is the best symbol set?, (3) What is the right number of symbols?

PHASE II: Several aircraft will be involved with JTIDS/MIDS. The cockpit architecture is different for each aircraft. This phase will determine the best match between the optimum display and symbol set found in phase I and the available resources in the various aircraft.

PHASE III: Symbol set characteristics will be optimized for each platform type. As cockpit upgrades occur, the JTIDS/MIDS requirements will be taken into account. The operator/machine interface efficiency will be known for the existing display sizes. Knowing this efficiency will aid in tactical decisions and network performance.

N93-202 TITLE: ADA Software Reliability Measurement Tools

This topic is CANCELLED.

N93-203 TITLE: Software Code Translation From Assembly to Ada

This topic is CANCELLED.

N93-204 TITLE: Bar Code Implementation for F/A-18 Production and USN Field Accounting

CATEGORY: Engineering Development;

OBJECTIVE: The objective is to assist in inventory control, failure tracking, a warranty control, and defect prevention by accurately tracking Weapon Replacement Supplier (WRA) locations and critical parameters from WRA supplier to Prime Contractor to the Fleet by utilizing a universal Bar Code Information System. The "bar code" plan and database requirements will be used at the Prime Contractor and at the WRA Supplier to reduce cost and approach 6 sigma quality.

DESCRIPTION: Providing an affordable WRA history throughout the life the WRA has the potential of significant cost avoidance for the industry as well as the U.S. Navy. Confirmed as well as intermittent failure history on a WRA provides the opportunity to rapidly analyze the defect patterns which can be used to increase the quality of the WRA and the availability of the aircraft.

PHASE I: The study must take into account the U.S. Navy support system and the Prime Contractor/Major Contractor production system. Selected WRA Suppliers will be contacted such that the proposed tracking system will maximize benefits to costs. The final report will quantify the long term savings to the U.S. Navy. The report will identify the optimum final state and contain a road map to get there.

PHASE II: A prototype architecture will be developed and field tested on the F/A-18 for a subset of the avionics. Existing computer hardware and software will be used where feasible; however, expenditures are expected. The prototype will focus on the highest contributors to avionic failures and high dollar WRAs. The prototype will include the Supplier of the WRA, McDonnell Douglas, and the U.S. Navy.

PHASE III: An integrated parts status and tracking computer system has proven their worth in the commercial universe with high dollar components such as computer systems. The Navy support system offers unique problems in implementation with potentially large financial and quality gains.

N93-205 TITLE: JTIDS/MIDS (Joint Tactical Information Distribution Systems/Multifunctional Information Distribution System) Cooperative Tactics

CATEGORY: Advanced Development

OBJECTIVE: The objective is to investigate how a system like MIDS can contribute to cooperative tactics such as ASW, CAS, A/A, and A/G warfare.

DESCRIPTION: JTIDS/MIDS provides the means for a fighter aircraft to transmit/receive a great deal of information to/from other fighters and Command and Control (CC) platforms. This networking greatly increases the effectiveness of the battle group. The details of how a system like JTIDS/MIDS can support A/A, A/G, ASW, CAS, cooperative jamming and cooperative passive ranging and tracking has not been fully investigated.

PHASE I: The study will research and document the form of presentation material the concept of operation for all warfare and applicable missions. The purpose of phase I is to narrow the scope of activity for phase II.

PHASE II: A warfare model will be used to quantify the performance of the concept of operations for the selected missions. An industry and government search of existing models will be performed. If one is not found, tailoring of an existing model will be part of this phase. Tactics will be hypothesized to support the concept of operations taking advantage of the JTIDS/MIDS network capabilities.

PHASE III: JTIDS/MIDS is planned to be fielded on U.S. Navy, U.S. Air Force, and NATO (including French) land, sea and air platforms. This phase will include the study of the best Navy only networks, joint U.S. forces networks, and joint NATO networks. The networks should take into account the connectivity requirements between force units. The model acquired in phase II will be used to investigate international battle group components.

N93-206 TITLE: Communication Network Saturation

CATEGORY: Advanced Development

OBJECTIVE: The objective is to determine how many aircraft to aircraft communication networks can be operating in a given geographical area.

DESCRIPTION: JTIDS/MIDS provides the means for a fighter to transmit/receive a great deal of information to/from other fighters and Command and Control (CC) platforms. However a given network can absorb a finite number of nodes before performance is degraded due to node interaction. JTIDS/MIDS is planned to be fielded on U.S. Navy, U.S. Air Force, and NATO (including French) land, sea and air platforms. It is planned that multiple JTIDS/MIDS networks will be operating within a given geographical area. These should be able to operate without interfering with each other to a great extent.

PHASE I: The study will research, model, and document the saturation point where performance becomes unsatisfactory. The study will determine the metrics of quality and unsatisfactory network performance with a given realistic topology.

PHASE II: Several U.S. Navy network topologies will be digitally modeled such that the saturation point for a given geographical area can be assessed. The product of this phase will be minimum areas for a set of U.S. Navy networks.

PHASE III: This phase should result in an algorithm or a set of rules (curves) determining the number of nodes and topology for a given geographical area. This phase will include best Navy only network, joint U.S. forces networks and joint NATO networks. The networks should take into account the connectivity requirements between force units for the type of conflict the U.S. is envisioned to get involved with.

N93-207 TITLE: Sensor Data Interface Definitions for Tactical Reconnaissance Systems

CATEGORY: Advanced Development

OBJECTIVE: Study and recommend a standard set of sensor data interfaces to be used in the implementation of Tactical Reconnaissance Sensors into a complete reconnaissance system.

DESCRIPTION: Advanced Tactical Air Reconnaissance System (ATARS) and EO LOROPS are two multi-service tactical reconnaissance development programs intended to provide a reconnaissance capability to a variety of airborne platforms including the F/A-18D. These systems interface with a ground station while in the air via a data link or after landing by removing the recorded digital data from the airborne tape recorder and supplying it directly to the ground station. The Joint Services Imagery Processing Station (JSIPS) is another multi-service development effort to provide a ground station to process and exploit reconnaissance data. The JSIPS is modular and includes a Tactical Input segment, imagery exploitation segments and provisions for a common Radar (data) processor to process airborne recorded phase history Radar data. The airborne sensor data processing and data handling capabilities of both ATARS and EO LOROPS is oriented and optimized for the specific sensors of those systems (i.e., Electro Optic) and no real design emphasis has been given to other types of reconnaissance sensors like radar. Although basic interoperability may be possible in the design of the ATARS, EO LOROPS and the airborne Radar sensor of the F/A-18D (APG-73), there currently is no standard or interface definition of Radar sensor output, control, and/or data formats between the sensor, the airborne reconnaissance system and the ground station.

PHASE I: The study should address the requirements for current and future sensors airborne platforms and ground processing/ exploitation stations. It should research and document the capabilities which currently exist or are readily available and not dependent on the development of a new technology.

PHASE II: Contractor shall develop a prototype architecture of a future sensor data interface.

N93-208 TITLE: Reconnaissance Data Recording

CATEGORY: Advanced Development; Weapons System Environment

OBJECTIVE: Study and recommend potential areas for development of recording technology which meets the need for airborne installations in Tactical Reconnaissance aircraft.

DESCRIPTION: The current standard for recording of tactical reconnaissance sensor data is the tape recorder. This technology was chosen primarily because if offers the advantages of high storage volume and high data records rates. The current state of the art in airborne tape recorders does, however, impose limitations which makes it less than ideal for the purpose. These limitations include:

-Limited operating temperature range (due primarily to tape limitations)
-Limited operating humidity restrictions (due primarily to tape limitations)
-The requirement for pre-conditioning of tapes prior to and during operation.
-Limitations on data manipulation due to spool rates of the recorders (i.e., Fast Forward/Rewind, etc.)
-The size and volume of current airborne qualified recorders

PHASE I: Conduct study and recommend an approach to overcome the limitations of current recording systems and still provide the functionality necessary to make Tactical Reconnaissance systems effective. This study should address and suggest areas of development over a wide variety of approaches to include improvement of tape recorders and the tape medium as well as the use of other record technologies. It should suggest near term (i.e., current or proven technology) solutions as well as identify directions for development of new technologies.

PHASE II: Contractor will provide an engineering development demonstration model for current technology.

N93-209 TITLE: Identification of Alternative Compliant Refrigerants to Replace Ozone Depleting Substances (ODS) Chemicals for Air Conditioning/Refrigeration Purposes in F/A-18 Aircraft.

CATEGORY: Exploratory Development; Environmental

OBJECTIVE: To investigate and identify alternate compliant refrigerants available which can be used to replace ODS presently used for refrigeration purposes (i.e., FREON).

DESCRIPTION: The ultimate goal of the U.S. Navy is to totally eliminate reliance on ODS chemicals, and to eliminate emissions into the atmosphere. The F/A-18 aircraft has air conditioning/ refrigeration systems which presently use a chloro-fluorocarbon (CFC) fluid which is classified as ODS. The United States pledged to eliminate CFCs by 1995. It is imperative to start exploring CFC alternatives so this goal can be achieved.

PHASE I: This study must include a thorough search for candidate materials which are non-CFC/non-ODS refrigerants suitable for F/A-18 equipment. The study must include a complete description of each material, including all known properties and provide limited test data.

PHASE II: Contractor shall develop a detailed system design package and fabricate an experimental air conditioning/ refrigeration system utilizing a refrigerant identified in Phase I study.

N93-210 TITLE: Development of Improved Battery for the Miniaturized Airborne GPS Receiver (MAGR)

CATEGORY: Engineering Development; Communications

OBJECTIVE: Review current research concerning battery selection for Miniaturized Airborne GPS Receiver then design and develop a battery that meets specifications, cost, reliability and maintainability, and environmental requirements.

DESCRIPTION: The MAGR is a GPS receiver procured by the GPS JPO as a non-developmental item. It is a five channel, dual frequency receiver designed for highly maneuverable aircraft. It appears that the current battery selection is alkaline cells for the MAGR standby battery application. The decision is apparently driven by cost and availability of this type battery. This type battery does not meet temperature specification. The operational environment will cause frequent replacement on the F/A-18. The MAGR is located in the F/A-18 LEX areas which requires excessive maintenance time to access for battery replacement. An alternative low cost, available and environmental battery that meets specifications is required.

PHASE I: Review the history and battery selection report for the MAGR and complete a design for a new battery that meets all specifications to include cost, availability, reliability, environmental and maintainability.

PHASE II: Contractor will provide an Engineering Development Model of the new battery with testing results showing compliance with specifications.

PHASE III: Pending results of the Phase II testing, this battery could be procured for the F/A-18 MAGR.

N93-211 TITLE: Development of Surface Mount Repair Tools/Operator Training

CATEGORY: Engineering Development; Training

OBJECTIVE: To develop (1) surface mount repair tools that would lower the skill level needed for operators for repair of SRA circuit cards or (2) training to upgrade operators' skills to the necessary level.

DESCRIPTION: Current tools used to remove and replace surface mounted microcircuits require a highly skilled repair person. The purpose of this project would be to either develop new tooling and repair aids or develop new training methods to train repair personnel.

PHASE I: Study tooling now available for repairing surface mount chips. Study training available.

PHASE II: Develop new tooling and training and make recommendations for best practice or procedures for repairing SRA.

PHASE III: Possible repair kit for SRA repair.

N93-212 TITLE: Electronically Erasable Programmable Read Only Memory (EEPROM) Failure Mode Analysis

CATEGORY: Exploratory Development; Weapon System Environment

OBJECTIVE: Develop more reliable EEPROMs.

DESCRIPTION: Determine which brand and types of EEPROMs are used most commonly on F/A-18 avionics. Breadboard them in "mock-up" situations to approximate the manner and speed at which they would run in representative selected applications in the aircraft. Gather data to determine whether the EEPROMs run in this situation most often experience (1) "pin" or "column" type failures, where the EEPROM fails as if a pin were stuck high or low; (2) "row" type failures where a specific entire memory location is faulty; (3) "cell" type failures where one particular memory location, one particular bit location is stuck high or low. We are not interested in failures due to defect in manufacture so much as the "random" and "wearout" failures experienced in the middle and end of the devices' failure rate "bathtub curve". EEPROM manufacturers are reluctant to provide such information because it does not serve their interests of appearing to provide a high-reliability product.

PHASE I: Perform an analysis and report the relative percentage rates of the different failure modes. This will be used to guide SRA-level test philosophy of EEPROMs used for parameter storage. If "pin" failures are common enough in a particular application. SRA-level Test Program Set developers can justify limiting EEPROM failure detections to "pin stuck high or low" for EEPROMs being used in that type of application. If "cell" failures are common, Test Program Set developers have information to justify a more intensive test such as a March II.

PHASE II: Phase II will consist of developing a demonstration EEPROM which could be tested in a laboratory, and will be highly reliable when used on aircraft avionics.

N93-213 TITLE: Product Data Exchange Standard (PDES) Parser

This topic is CANCELLED.

N93-214 TITLE: Data Storage Unit (DSU) Data Analysis

This topic is CANCELLED.

N93-215 TITLE: AutoTEST Model Vhsic Hardware Descriptive Language (VHDL) Parser

This topic is CANCELLED.

N93-216 TITLE: Validate AutoTEST Output

This topic is CANCELLED.

N93-217 TITLE: Development of Tools for CALS Implementation

CATEGORY: Engineering Development; Computers

OBJECTIVE: To develop tools to allow MDA and vendors to implement CALS (Computer-Aided Acquisition and Logistic Support) requirements. Two possible tools includes (1) a TPI (Test Program Instruction) that is in a format that can be called up on the CASS (Consolidated Automated Support System) station and (2) a hand-held computer, containing the information ordinarily in the tech manuals, which can be used to troubleshoot problems on the aircraft.

DESCRIPTION: Tools are needed to support CALS, a DOD and industry effort to digitally transfer information throughout the life cycle of a program (acquisition, design, manufacture, support ....) The concept requires a means to transmit, receive, store and manage "automated technical information." Currently, Support Equipment and repair personnel must use paper copies of the Test Program Instruction and the tech manuals to troubleshoot problems with avionics, test equipment and aircraft. Digital transfer of this information to the CASS station or to the hand-held computer would eliminate the need for the paper copies.

PHASE I: Generate a report outlining the approach to be taken. Evaluate CASS station capabilities and interface, and data formats that can be transferred onto CASS from other systems, and focus on one or two alternatives. Compare hand-held computer capabilities and methods of transferring information to the computer from existing software/hardware environment. Select the best method.

PHASE II: Design and produce documentation for, and demonstrate a working model of, an on-station TPI or hand-held computer.

N93-218 TITLE: F/A-18 Aircraft Canopy Reflections

CATEGORY: Engineering Development; Materials

OBJECTIVE: Develop methods, materials and processes to reduce the canopy reflections created by crewstation displays on the F/A-18 canopy.

DESCRIPTION: The current F/A-18 display suite creates reflections on the canopy during the night operations that interfere with pilot vision. As increasingly more situational awareness is required by the crew members, more and larger display surfaces will be required to accomplish these tasks thus increasing the reflection problems.

PHASE I: Evaluate and create a optical model of the F/A-18 canopy and its existing light sources. Evaluating the display light source and canopy material types and characteristics for the F/A-18 A/B/C/D/E/F. Determine the technical merit and feasibility of methods, materials and processes to reduce the canopy reflections.

PHASE II: Develop the required methods, materials and processes and apply that concept to the analytical model and to one F/A-18 aircraft or representative mockup for proof of concept. The SBIR will be responsible for the test activity but will be aided by MDA for verification of the aircraft/display integration.

PHASE III: Follow on effort will depend on the extent of the reflection reduction, i.e., will the design changes reduce the reflections to the extent that enhances the night operations?

N93-219 TITLE: Fire Control System for Rockets and Cannon

This topic is CANCELLED.

N93-220 TITLE: NDE/I Assessment of Adhesive Bond Strength

CATEGORY: Advanced Development; Composites

OBJECTIVE: Develop nondestructive inspection method to quantify the bond strength of adhesively bonded joints for both metallic and nonmetallic structures. Any resulting measurement values shall be correlated with destructive testing results and other data on adhesive bond strength.

DESCRIPTION: Current nondestructive inspection methods do not measure strength of adhesive bond joints. A nondestructive inspection method for both production and field application to measure bond strength is required to ensure structural integrity of adhesively bonded structure.

PHASE I: Should use specimens to test the principle behind the approach selected.

PHASE II: Should use the approach outlined in Phase I to develop and demonstrate techniques to measure/assess bond strength. The design, development and test of a prototype unit shall be accomplished. The prototype unit shall be a deliverable.

PHASE III: A manufactured unit could be used commercially.

N93-221 TITLE: NDE/I Assessment of Heat Damage to Advanced Composites

CATEGORY: Engineering Development; Composites

OBJECTIVE: To develop nondestructive methods and analytical procedures/techniques to determine the extent of heat damage/ degradation in advanced composites. These efforts will require correlation of composite mechanical and physical properties (original states and degraded states) with NDE/I measurements. Furthermore, an accept and reject criteria for thermal damaged composites must be established.

DESCRIPTION: There are a variety of circumstances that expose advanced composites to excessive heat. Typically the sources of heat include hot spots in heat blankets (used for composite repair), failed thermocouples over driving heat blankets, adjacent heat sinks which require more heat, engine fires, etc. The development of NDE/I methods/techniques is essential to ensuring the structural integrity of advanced composites. The contractor should address state-of-art Navy aircraft composite systems.

PHASE I: Should consist of a study outlining the methodology to address the above issues with sufficient data to demonstrate feasibility.

PHASE II: Should use the approach outlined in Phase 1 to develop and demonstrate techniques to measure/assess thermal degradation in graphite/epoxy composites representative of those used in Navy aircraft. The design,development and test of a prototype unit shall be accomplished. The prototype unit shall be a deliverable.

N93-222 TITLE: Integrating Computer Aided Curing of Composites with Advanced Tooling Concepts

CATEGORY: Engineering Development; Composites

OBJECTIVE: To develop/integrate computer software that could function as a tooling design aid. There have been manufacturing technology programs which have addressed computer aided processing and an advanced tooling program. It is desired to have computer hardware and software that will be capable of performing CAD/CAM functions for tooling required for composites. Ideally this program should be capable of producing tooling for composites that induces minimal to no stresses into composite parts.

DESCRIPTION: There are a variety of circumstances that induce stresses into advanced composite parts. Mismatch of coefficients of thermal expansion (CTE) between tool and composite part. The contraction of the thermosetting resin (matrix) during its exothermic reaction which occurs upon curing also causes stresses. Part lock on is another problem where the cured composite part has to be pried off the tool. These are undesirable events which cause stresses in the cured composite part. The contractor should address state-of-art Navy aircraft composites, and how an appropriate computer system (hardware and software) could relieve these undesirable stresses.

PHASE I: Should consist of a study outlining the methodology to address the above issues with sufficient data to demonstrate feasibility.

PHASE II: Should use the approach outlined in Phase 1 to acquire/develop computer hardware and software capable of performing CAD/CAM functions for graphite/epoxy composites. This system shall be capable of designing/producing tooling for composites which induces minimal stresses into the composite part. The prototype computer hardware and software shall be a deliverable.

N93-223 TITLE: Optimized Mach Number Immune Parachute Deployment Sequencer

CATEGORY: Advanced Development; Weapons System Environment

OBJECTIVE: Develop a parachute deployment sequencer that is Mach immune and which provides optimum timing of recovery parachute deployment under all ejection conditions.

DESCRIPTION: The optimized parachute deployment sequencer shall provide unique capabilities not provided by presently available equipment. These would include, as a minimum, the following: (1) Assure immediate main recovery parachute deployment in any low altitude, low airspeed ejection and in any high airspeed ejection assure immediate main recovery parachute deployment after the maximum safe airspeed for its deployment has been reached under at least the following combinations of ejection parameters: Any ambient temperature condition, any ejected weight condition within the pilot population, and any flight path dive/climb angle. (2) Prevent main recovery parachute deployment until an airspeed safe for deployment has been reached even when a drogue failure or other anomaly has occurred such that a longer time for deceleration to that safe airspeed was required. (3) Prevent main recovery parachute deployment until an airspeed safe for deployment has been reached for all supersonic ejection conditions where the total and static air pressures that are measured on the seat (behind the detached shock wave) indicate both a low airspeed and a low altitude. (4) Provide the capability of a pre-ejection input from the aircraft air data computer to the sequencer to select one of three levels of the main parachute safe deployment airspeed such that low, medium or high risk ejection conditions can be accounted for. All the above listed capabilities shall be provided without requiring any sophisticated sensor or transducer measurements other than static pressure and total pressure. The sequencer should be microprocessor based with state-of-art components and shall be powered by a battery source having a rapid rise output with a duration of three hundred or more seconds.

PHASE I: The design of the sequencer input data, logic circuits, power supply requirements, data storage memory capacity, et cetera along with a written description of the operational sequence and sequencing capabilities shall constitute the Phase I deliverables.

PHASE II: Two prototype optimized escape system sequencers shall be assembled and demonstrated in bench tests with static pressure and total pressure input histories representing ejections under some selected extreme and unusual escape conditions which could cause other sequencers to provide either early catastrophic or unacceptable delayed main recovery parachute deployment. Upon successful bench testing, two high speed track tests with maximum and minimum ejected mass conditions using a suitable ejection seat test bed would be run.

PHASE III: A parachute deployment sequencer has strong potential for implementation in future tactical aircraft escape systems. In addition, there are high speed drone, missile, and capsule recovery applications.

N93-224 TITLE: Conformal UHF SATCOM Antenna for Tactical Aircraft

CATEGORY: Exploratory Development; Weapon System Environment

OBJECTIVE: A need has been identified for UHF Satellite Communications (SATCOM) for beyond line of sight communications and participation in Navy communications nets. Currently available UHF SATCOM antennas are unsuitable for the Navy's high performance aircraft because of form factor, weight, intrusion into the aircraft and/or protrusion into the air stream. This research will be used to develop an antenna design.

DESCRIPTION: This study will identify electrical and mechanical concept designs of conformal UHF SATCOM antennas for high performance aircraft. The performance goals in the frequency ranges of 240 Mhz to 275 Mhz for receive and 290 Mhz to 320 Mhz for transmit are as follows:

Gain	+3 dBiC	Power Handling:	150W CW
VSWR:	1.5:1 (2.0:1 Max)	Size:	12" Dia x 5"
Axial Ratio	2 Db at 0 degrees	Weight:	15 lbs.
	8 Db at 80 degrees	Installation:	Flush Mount + 3"

PHASE I: Using their own materials, the company will build "Bread board" models of the most promising design/designs. These models will be used, by the company, to measure and evaluate performance. The deliverable for Phase I will be a final report describing the preliminary designs, performance of the "bread board" models and assessment of potential technical risks.

PHASE II: Build a "Brass Board" prototype of the most promising Phase I design. The prototype and performance data will be delieverables.

PHASE III: A Navy Phase III and/or private Phase III is possible.

N93-225 TITLE: NDE/I Assessment of Heat Damage to Advanced Composites

This topic is CANCELLED.

N93-226 TITLE: Integrating Computer Aided Curing of Composites with Advanced Tooling Concepts

This topic is CANCELLED.

N93-227 TITLE: Nonsinusoidal Technology Applications to ASW Radar

CATEGORY: Exploratory Development; Weapons System Environment

OBJECTIVE: The emergence of acoustically quiet, ROW diesel-electric threats in shallow water/LIC scenarios has led to the need for nonacoustic sensor systems to complement traditional acoustic means for search/detect/localization. Current radars cannot be used against submerged targets; new nonsinusoidal radars give promise of doing this. The objective is to investigate the feasibility and application of nonsinusoidal radar technology to U.S. Navy maritime patrol aircraft (MPA) and to Air ASW platforms.

DESCRIPTION: This SBIR Topic will investigate, analyze, implement, test and demonstrate a prototype nonsinusoidal radar for detection of underwater targets. A theory for the propagation of slowly varying electromagnetic (EM) signals through seawater will be developed and used to predict radar performance as a function of radar design parameters. A new transmitter (antenna and driver) and receiver, based on innovative radiator technology, will be designed and prototyped. The prototype will be tested and its efficiency will be determined. Analyses leading up to the design will address such issues as: optimum pulse length and frequency; target depth determination; size, weight and power requirements for air platforms. The prototype system will be demonstrated.

PHASE I: Develop a theory describing the propagation of slowly varying EM signals through seawater. Conduct investigations and tradeoff analyses to determine the feasibility and optimum design for the new nonsinusoidal radar system. Initiate and complete the radar design. Document the theory, all investigations and analyses and results, and the proposed design in a Technical Report.

PHASE II: If Phase I is successful, enhance the theory and the design to optimize for subsurface detection in shallow water scenarios. Build a prototype transmitter, receiver and radiator. Test the prototype, and compare with theoretical predictions. Analyze the test data to determine the radiator efficiency and field strength, and the signal propagation characteristics as a function of seastate. Deliverables will be a Final Technical Report, the prototype, and associated documentation.

PHASE III: If Phase II is successful, the Navy will transition nonsinusoidal ASW radar to the MPA and Air ASW communities.

N93-228 TITLE: Precious Metal Enhanced Aluminides for Turbine Components

CATEGORY: Engineering Development; Weapons System Environment

OBJECTIVE: To evaluate several precious metals for alloying with nickel aluminides to provide enhanced oxidation and sulfidation resistance to Naval turbine engine components.

DESCRIPTION: Years of service data on turbine components (blades and vanes) have demonstrated that simple nickel aluminides do not provide the necessary environmental protection to eliminate effects of sulfidation and oxidation. Simple aluminides are attractive in that they provide good protection at a very low price. The aluminide is nearly always produced by a pack cementation process and whether it conforms to Pratt and Whitney (PWA 70), General Electric (CODEP-B1), or Rolls-Royce (Pack) specifications the aluminide product has similar properties. The marine environment encountered by Naval turbine engine components often degrades the protective characteristics of the coatings thus requiring early removal of the components.
Several studies have been conducted to evaluate enhanced vs unenhanced coatings, however, other than concluding that platinum adds significantly to high temperature oxidation resistance, only limited studies have been conducted to identify other precious metals which perform equivalently to platinum (when tested equally) and yet cost less. The platinum aluminides nearly always outperform simple aluminides, however, the high cost of platinum could add $50,000 or more to the price of a turbine engine.

PHASE I: Will consist of an evaluation of precious metals (Series VIII) and the theoretical products and properties resulting from the aluminide forming reactions. If promising combinations are found and show economical justification, Phase II will occur.

PHASE II: Will produce enhanced aluminide coatings on test coupons (3 alloys chosen by Naval Engine Airfoil Centerin conjunction with contractor) for 500 hour testing at 9000C (marine atmosphere), as well as fatigue testing. Actual engine components may be produced for engine testing.
Upon successful completion of testing, the engine CFA's will be requested to formally accept the proposed enhanced aluminide as an alternate coating for applications where platinum aluminide has already been tested and accepted.

N93-229 TITLE: Centrifugal Filtration of Corrosive Process Solutions

CATEGORY:

OBJECTIVE: To develop the technology and equipment to centrifugally filter corrosive process solutions used at aircraft maintenance activities. If successful, this technology would extend process solution lives by extracting harmful particulates, sludges and residues.

DESCRIPTION: Historically, large volume process solutions are prematurely dumped due to contamination build-ups that cannot be simply filtered out. The high temperature and corrosive nature of these solutions preclude the use of standard filtration methods. The centrifugal filters are dynamic devices that spin out the contaminants from the solution. The cleaned solution is returned to the process tank and the separated hazardous waste is drawn off into disposal drums. Conservative estimates show that removal of contaminants from alkaline cleaning solutions and electroplating baths can at least double and in many cases quadruple solution life. For example, a 1600 gallon tank of a highly concentrated, chelated alkaline scale conditioner costs over $22,000 to make up and over $8,000 to dispose of it twice a year. Although the existing centrifugal filters work well on fairly neutral, benign solutions, the technology has not been demonstrated on high temperature, corrosive solutions.

PHASE I: Phase I should consist of a study outlining the approach which will be undertaken to achieve the technology required to develop the centrifugal filter designs for all high temperature corrosive process solutions identified by the preparing activity.

PHASE II: Phase II should utilize technology developed in Phase I to actually build and deliver to the government a high capacity, efficient corrosive solution centrifugal filter that is skid or wheel mounted for portability. The government will test the filter on the variety of corrosive solutions that was identified in Phase I.

PHASE III: Will be a private commercial venture.

N93-230 TITLE: Sodium Bicarbonate Blast Decreasing and Recycling

CATEGORY: Exploratory Development; Manufacturing

OBJECTIVE: To research and develop methods to utilize sodium bicarbonate blasting to degrease and decarbonize contaminated parts; then, to separate the grease, oils and particulates from the effluent; and, finally, to recover and recrystallize the sodium bicarbonate for further use.

DESCRIPTION: The use of ozone depleting chemicals for decreasing parts will be forbidden as early as 1 January 1996. The common vapor degreaser solvent, 1,1,1-trichloroethane, will be eliminated.
Abrasive blasting with sodium bicarbonate works very well as a degreaser and has been successfully demonstrated at several NADEPs. The major drawback to this process is the relatively large amount of hazardous waste generated. The contamination content of the effluent is estimated to be 2% of the total volume, however, the entire waste stream must be handled as hazardous. Disposal cost for containerized hazardous waste is currently $17.50 per gallon and is expected to double within the next year. This project will research methods in which oils, greases and particulates are removed from the spent sodium bicarbonate and water waste stream. further processing of the solution will recrystallize the sodium bicarbonate for recovery and reuse which will enable the remaining water to be discharged into the sewer system or reused in the cleaning process. Ultimately, the recrystallized sodium bicarbonate will be ground into the original 80-120 grit size, mixed with about 0.5% Cabosil and reused as new blasting media.

PHASE I: Investigate procedures to integrate the existing sodium bicarbonate blasting technology with waste stream contaminant removal, recrystallization of sodium bicarbonate, and remanufacture or reuse of the sodium bicarbonate blast media. The approach can be a completely closed loop continuous recovery or off-line batch recovery system.

PHASE II: Construct a demonstration or pilot unit that will contain the entire blasting operation and recovery/recycling system in a walk-in blast booth with a small amount of add-on equipment. A typical set-up would be a standard paint booth with a grated floor and a flowing water media trap that dumps into a sump where the effluent can be stored pending recycling procedures. The design and methods used to demonstrate this technology will be up to the bidder. The working size of the pilot booth should be at least 10' long X 10' high X 10' wide.

PHASE III: There is potential for a phase III effort.

N93-231 TITLE: Real-Time Wavelet-Based Image Compression

CATEGORY: Exploratory Development; Communications

OBJECTIVE: To develop real-time wavelet-based approaches for image compression to be utilized for narrow bandwidth image data links.

DESCRIPTION: Image compression technology employing wavelet transforms offers the potential for the high compression ratios necessary to transmit sensor imagery over narrow bandwidth channels. This technology would provide image data link capability for many ships and aircraft, including stealth aircraft, by utilizing existing radio equipment and antennas. The use of existing communication channels would reduce costs, simplify logistics, and improve interoperability.
Innovative ideas are sought for the design and implementation of a system applying wavelet theory to real-time image compression. Real-time in this case means that the compression/reconstruction process operates quickly enough that no noticeable image latency is introduced as viewed by an operator on a monitor. Solutions are sought for compression of both static (single frame) images as well as video sequences (consecutive frames in time). Innovative solution, which utilize the wavelet transform domain for supplementary signal processing mechanisms as a function of position in the image or frequency subband, are welcomed. Emphasis will be placed on solutions which operate in real-time and provide for the best tradeoff of image quality versus compression ratio for digital imagery from EO, IIR, and LADAR sensors. Design should take into account sensitivity of reconstructed image quality to jamming and noise environments.

PHASE I: Provide detailed analysis of the proposed design, including feasibility of the proposed algorithms, and a plan for experimental evaluation.

PHASE II: Design software and hardware, and perform gate level simulations and timing analyses to verify the technical approach. After a successful preliminary design review, fabricate and test a hardware prototype of the wavelet image compression system, characterizing system performance in a noise/jamming environment.

PHASE III: There is potential for a Navy funded Phase III effort.

N93-232 TITLE: Government Wide/Para-Military Applications of Unmanned Air Vehicles (UAVs)

CATEGORY: Advanced Development; Weapons System Environment

OBJECTIVE: Evaluate and demonstrate that systems from DoD UAV programs can be applied to various government-wide and para-military applications of UAVs in an effective and affordable manner. The benefits of additional development options, cost reduction, reliability, supportability, and enhanced performance will then be felt in ongoing DoD UAV programs.

DESCRIPTION: A variety of air vehicles, sensors, data links, and ground control stations have completed or are completing development for DoD UAV programs. The integration of these technologies into effective and affordable UAV systems which will have more cost effectiveness and availability than manned systems to meet a significant number of potential para- and government-wide applications, e.g.: drug enforcement as related to the efforts of the Office of National Drug Control Policy, environmental/disaster monitoring; and law enforcement support, including border control and communications relay; and Corps of Engineers and National Guard surveillance and monitoring of roads; dams and rivers; pipelines; high tension power lines; fishing areas, etc.

PHASE I: Provide an analysis of the cost benefit and operational effectiveness of the use of UAVs in various government wide/para-military applications. Analyze the potential applications and provide a plan to demonstrate the utility of a UAV system meeting various applications, including, but not limited to those outlined above.

PHASE II: Demonstrate various missions determined in Phase I. Determine the support, control, cost and benefits of para-military/government wide applications. Determine policy concerning federal, state and local laws and policies regarding UAV use in government wide/para-military applications.

PHASE III: Integrate development aspects of Phase I and II to provide operational UAV support systems in conjunction with government-provided UAVs for the applications which have been proven fruitful.

N93-233 TITLE: Unmanned Aerial Vehicle Electronic Decoy Payload

CATEGORY: Machine Intelligence; Robotics

OBJECTIVE: To investigate the feasibility of an electronic decoy payload for Unmanned Aerial Vehicle (UAV) applications and demonstrate the Decoy UAV payload.

DESCRIPTION: To ensure the success of a military campaign, U.S. Forces must gain air superiority and conduct an effective air interdiction war. However, a successful air war cannot be guaranteed because of the lethality of modern air defense weapons prevalent on the battlefield. Therefore, the Suppression of Enemy Air Defense (SEAD) will be an integral part of any military campaign in the future. Using the Decoy UAV as part of the SEAD mission, the effectiveness of our military forces can be enhanced and the survivability of our air assets can be increased. The UAV electronic decoy payload will replicate electronic signatures of various aircraft. It will be capable of generating multiple false targets to draw enemy fire in order to protect our air assets. The payload will also have built-in self-protection techniques to prevent enemy radar from locking-on to the UAV. The typical decoy currently in the inventory is limited in the use of its radar augmentation device. The device can replicate the electronic signature of only one aircraft. Furthermore, its target signature does not have the fidelity to spoof a sophisticated radar, and the existing decoy cannot be recovered as in the case of the proposed Decoy UAV.

PHASE I: Propose a design of an electronic decoy UAV payload which will have a programmable waveform/signal generator and an embedded delay line. The device will be capable of coherent measurement of incoming signals; automatic waveform storage and recall; performing both amplitude and phase modulation to

replicate friendly aircraft signatures; simulating target movements; and generating multiple false targets. The design will be verified by simulation.

PHASE II: A brassboard programmable waveform/signal generator/delay line will be built for demonstration.

PHASE III: A complete UAV electronic decoy payload including the receiver, power amplifier, and antennas will be fabricated for flight test.

N93-234 TITLE: Automatic Target Recognition/Cuing Using an Unmanned Aerial Vehicle Multispectral Imaging Sensor

CATEGORY: Exploratory Development; Signal Processing, Data Fusion

OBJECTIVE: To investigate the feasibility of using a multi-spectral imagery (MSI) sensor for Unmanned Aerial Vehicle (UAV) applications and demonstrate the automatic target recognition/cuing using MSI sensors.

DESCRIPTION: Different man-made or natural targets can exhibit accentuated responses to sensors operating in different spectral bands. Millimeter-wave Synthetic Aperture Radar (SAR)/radiometer and multi-band infrared sensor technology incorporated into a MSI payload can detect responses in both the millimeter-wave and infrared frequency spectrums. MSI payload data can yield a wealth of information for planners of naval and amphibious warfare operations. For ocean surveillance, MSI payload data can measure wave height, determine sea state, forecast ocean condition, identify targets, and detect ship wakes. For over-land reconnaissance, MSI payload data can be used to identify terrain features, types of vegetation, camouflage nets, concealed targets, snow and ice layer composition, and soil conditions. MSI payload data can also be used to predict beach condition, determine water depth near the shore, and locate inshore mines. Finally, MSI payload data can contribute to Automatic Target Recognition/Cuing (ATR/C) when combined with signal processing techniques. Currently, MSI data originating from reconnaissance satellites is not responsive to user needs due to the long time between satellite visits to the area of interest. A UAV MSI system would be more responsive to the operational commander's needs because it can loiter over the area of interest for extended periods of time and can provide the necessary coverage in near-realtime. MSI sensors have been employed successfully by the civilian sector in remote sensing applications, e.g., forecasting crop yield, surveying forests, mapping of potential mineral resources, patrolling ice formation for maritime safety, monitoring pollution, etc. It is envisioned that the UAV MSI system will be capable of performing similar civilian missions. These areas should also be investigated.

PHASE I: Determine the availability and suitability of various imagery exploitation and target recognition/cuing algorithms, and catalogue these algorithms for review by the UAV Joint Project Office. Perform verification of those algorithms through simulation using available imagery data.

PHASE II: Obtain suitable infrared sensor and millimeter-wave SAR/radiometer hardware and configure them into a flying testbed. Conduct flight tests and MSI measurements on targets of interest. Perform validation of those MSI algorithms deemed suitable for UAV applications.

PHASE III: Use results of the above investigations to determine the UAV MSI payload requirements and feed these inputs into a UAV MSI payload prototype effort. Fabricate a prototype UAV MSI payload.

N93-235TITLE: EO/IR Sensor Integration for Target Identification

CATEGORY: Exploratory Development; Machine Intelligence

OBJECTIVE: Combine sensor data for EO/IR sensors for automatic target recognition. Hardware and Software, shall be high speed providing ID generally in less than 5 seconds under ideal conditions and robust.

DESCRIPTION: Next generation Navy platforms will be equipped with Electro-Optic systems such as a CCD television similar to those now deployed in the F-14, and Third Generation Thermal Imaging systems. A systems is required that will receive and combine inputs from EO and IR sensors for rapid, accurate, and reliable Non-Cooperative Target Recognition (NCTR).

PHASE I: The deliverable for Phase I will consist of the plans, drawings, and milestone for a demonstrable prototype.

PHASE II: The deliverable for Phase II will be a prototype hardware and software system that demonstrates automatic target recognition and sensor fusion for EO/IR sensors. Outputs will be compatible with currently developing Navy Hardware, such as AN/UPX-30. Cueing will be from existing Navy sensors.

PHASE III: A Navy funded Phase III effort is anticipated.

N93-236TITLE: EO/IR Sensor Integration/Fusion for Target Identification

CATEGORY: Exploratory Development; Machine Intelligence

OBJECTIVE: Design and develop a small and cost effective systems for the automatic, rapid, accurate, and reliable identification of friendly forces to prevent fratricide and improve battle management.

DESCRIPTION: Major Naval platforms are equipped with several sensors and devices to determine the identity of unknown targets. A simple and cost effective automatic systems is needed for use by smaller platforms and individual weapons systems for the identification of friends. The systems must integrate easily with existing ID sensors and combiner/processors.

PHASE I: Phase I efforts will address the design and development of a new system for the cost effective identification of friends. The deliverable will be the drawings and figures and milestones necessary to produce a demonstrable prototype in Phase II.

PHASE II: Phase II will provide for the fabrication, test and demonstration of a new systems for the rapid automatic identification of friendly platforms.

PHASE III: A Navy funded Phase III effort is anticipated.

N93-237TITLE: Solid State Digital Data Buffer

CATEGORY: Exploratory Development; Weapons System Environment

OBJECTIVE: In the extreme environments experienced in high performance aircraft high rate digital tape recording of images from electro-optical sensors is difficult. Airborne digital tape recording equipment has been developed which records directly on tape. The equipment is expensive and heavy. Reliability and cross play of such equipment has not been adequately proven. The objective of this effort is to develop a solid state buffer which will store imagery data for transfer at a slower rate recording on tape.

DESCRIPTION: The equipment should function with a reliability of at least 125 Hrs MTBF and operate under the following conditions without externally supplied environmental conditioning:

a. Temperatures ranges: from -30□C to +50□C
b. G-loading: -3G to +7G
c. Pressure altitude range: Sea level to 50,000 feet

Performance characteristics:

a. Data storage rate: 240Mb/sec

b. Data transfer rate to digital tape recorder: 60 Mb/second or less

c. Data storage capacity: 10 minutes of imagery data from Advanced Tactical Airborne Reconnaissance System (ATARS) or Electo-Optical Long Range Photographic System (EO-LOROPS).

d. The goal is for the equipment to store and transfer data without compression. Data compression schemes will be considered as a last resort.

Physical characteristics:

a. Weight: 35 pounds maximum

b. Size: 6"x10"x18" maximum

Anticipated usage: Internal and pod mounted installation on the Navy/Marine Corps F/A-18 aircraft for use with ATARS and EO-LOROPS.

Integration requirement: The system shall store data from the ATARS and EO-LOROPS sensors and shall be integrated with the ATARS digital tape recorder for use on the F/A-18 aircraft.

Government Furnished Equipment (GFE): Access to ATARS and EO-LOROPS will be provided during Phase I. ATARS and EO-LOROPS sensors and a digital tape recorder will be provided as GFE during Phase II.

PHASE I: Phase I is expected to consist of a study culminating in the delivery of a report which would outline the approach to be undertaken to achieve the stated requirements.

PHASE II: It is expected that the deliverable under a Phase II contract would be a breadboard system which would undergo testing with ATARS and/or EO-LOROPS on an F/A-18 aircraft. The system will be tested by Naval Aviation Warfare Center, Aircraft Division, Patuxent River, Maryland.

PHASE III: If the system proves out during Phase II, a funded Phase III EMD effort would likely ensue.

N93-238 TITLE: Digital Data Compression/Decompression Algorithms

CATEGORY: Exploratory Development; Weapons System Environment

OBJECTIVE: The storage of digital data from tactical airborne imaging sensors requires very high data rate digital tape recorders given the compression/decompression algorithms currently in use. The high data rates and the environmental extremes experienced in tactical aircraft require heavy and expensive high speed recorders and excessive environmental control requirements. The reliability and cross play capabilities of existing recorders have not yet been proven. Improved data compression/decompression schemes that provide higher compression ratios yet create no loss of resolution of the imagery after decompression will permit lower rate, lighter, less environmentally sensitive, and more reliable digital tape recorders.

DESCRIPTION: The algorithms should provide high ratio compression/decompression schemes to permit digital data from the Advanced Tactical Airborne Reconnaissance System (ATARS) and the Electro-Optical Long Range Oblique Photographic System (EO-LOROPS) to be recorded 60 Mb/second or less with no less image resolution than would be achieved without compression/decompression. The software developed must be compatible for use in ATARS or EO-LOROPS.

Government Furnished Equipment: During Phase I access to required components of ATARS and EO-LOROPS will be provided at a government facility. During Phase II required components will be provided as GFE at the contractors' facility.

PHASE I: Phase I is expected to consist of a study culminating in the delivery of a report which would outline the approach to be undertaken to achieve the stated requirements.

PHASE II: The Phase II effort would result in delivery of compression/decompression software for testing in ATARS and/or EO-LOROPS at a government facility. Testing may be limited to ground testing or may include airborne testing.

PHASE III: If the compression/decompression algorithm proves out during Phase II, a Phase III EMD effort would likely follow.

N93-239 TITLE: Computer Algorithms

CATEGORY: Advanced Development; Computers

OBJECTIVE: Develop computer algorithms for use in guidance system evaluations.

DESCRIPTION: The computer models will replicate the search, identify, lock, and track various targets in the infrared and low-light band widths for guidance sections. The model will evaluate various aspect angles with relation to background environments and tracking rates. The models will be innovative in nature and coordination with Naval Air Systems Command, AIR-5401B, is required to understand current modeling techniques.

PHASE I: Develop a model for review by Naval Air Systems Command, AIR-5401B,. Produce several tracking runs for model validation.

PHASE II: Compile, debug, and package model for delivery.

N93-240 TITLE: Sidewinder 9X Missile Domes

This topic is CANCELLED.

N93-241 TITLE: Simulation Enhancement of the FA-18 Flight Simulation with Special Emphasis on Departures and Out-of-Control Airplane Motions and Control Power.

This topic is CANCELLED.

N93-242 TITLE: NDE/I Assessment of Adhesive Bond Strength

This topic is CANCELLED.

N93-243 TITLE: Aircraft Repair and Modification Cost Estimating Query System

CATEGORY: Engineering Development; Computers

OBJECTIVE: Develop parametric cost estimating criteria and applicable values for aircraft repair and modification that will allow planners and estimators to produce project estimates by compiling various like and similar task estimates from previous projects.

DESCRIPTION: Cost estimates from previous projects will be compiled into a database with query capability by various criteria such as system, type of modification or repair, pieces of equipment to be installed, locations of the equipment, facilities available where the installation will be done, equipment that may be used for the installation, and the personnel skills available. Feedback from the actual expenditures should be used to revise the database to tailor estimates for a particular facility. This database will reduce the time needed to produce a cost estimate with a high degree of reliability.

PHASE I: Develop parametric cost estimating criteria. Design database structure for parametric data. Design algorithm to tailor and update criteria based on actual execution of previous projects.

PHASE II: Establish cost estimating values based on parametric criteria developed during phase I. Load values into database. Develop user-friendly interface menus for producing estimates. Provide report writing capability for hard copy of estimate. Interface algorithm to tailor and update parametric criteria using actual execution data and put this information into the estimating database.

PHASE III: Implement cost estimating system into current planning procedures of specific facility.

N93-244 TITLE: Novel Magnetic Detection Schemes based on Cooperative Phenomena in Nonlinear Dynamic Systems

CATEGORY: Exploratory Development.

OBJECTIVE: To develop new magnetic sensor technology by exploiting the nonlinear dynamic characteristics of magnetic sensors.

DESCRIPTION: New magnetic sensor technologies are sought, which utilize stochastic resonance and/or other cooperative effects in nonlinear dynamic systems to circumvent or take advantage of intrinsic sensor noise. Innovative techniques or devices which greatly improve existing systems are preferred as are collaborations with leading researchers in the nonlinear dynamics community. The offerors must provide clear models and explanations of the fundamental processes and quantitative descriptions of how they may be improved using techniques of cooperative stochastic phenomena in nonlinear dynamic systems. Straightforward marginal improvements of existing sensors are not sufficient. The sensors must be of practical use to the Navy and practical demonstrations are desired.

PHASE I: A detailed concept feasibility study to model the sensor performance will be carried out. The role of stochastic resonance and/or other nonlinear dynamic effects in the fundamental physical operation of the sensor should be discussed.

PHASE II: The results of PHASE I will be utilized to design and fabricate a novel (experimental) sensor that can detect weak magnetic signals (dc and non-dc) more efficiently than state-of-the-art sensors. The sensor characteristics (including all associated software) will be evaluated and compared to existing technologies.

PHASE III: The system will be installed and tested in the ADT units being developed by NAVAIR.

NAVAL AIR WARFARE CENTER/WARMINSTER

N93-245 TITLE: Forward Looking Infrared (FLIR) Image Enhancement

CATEGORY: Advanced Development; Photonics

OBJECTIVE: To demonstrate improved optical resolution by a factor of two and to evaluate the resolution-enhanced imagery for recognition of tanks and ships.

DESCRIPTION: The study will demonstrate that FLIR sensor range can be expanded in tank and ship identification. Target recognition in the infrared band is severely limited by the size of the FLIR diffraction resolution limit by 1.2 times the wavelength, divided by the entrance pupil diameter.

PHASE I: Validate predicted resolution benefits through analysis and limited simulation. The techniques will be demonstrated by using all the information available in the optical calibration data, enhancing the imagery in small patches, and solving the boundary value problem for enhancement of these small patches of imagery. This technique is called video enhancement signal processing for improved resolution (VESPIR).

PHASE II: Demonstrate benefit using actual prototype FLIR enhancement systems and digital FLIR video. All demonstrations and testings shall be documented and reported.

PHASE III: This topic has the potential for transition to PHASE III via linkage between small business and the V-22 prime contractor and/or component suppliers.

N93-246 TITLE: Antenna/Airframe Math Model

CATEGORY: Advanced Development; Simulation and Modeling

OBJECTIVE: To design a viable low profile/conformal antenna configuration that is consistent with the co-location coupling criteria for the CV-22 SOF aircraft.

DESCRIPTION: An urgent need exists for low profile/conformal antennas that will replace the projecting antennas now on the MV-22 and planned for the CV-22 aircraft.

PHASE I: The study will develop a math model with which to complete definition of criteria necessary to design the low profile/conformal antennas and to optimize their location on the aircraft.

PHASE II: Using the math model and criteria developed in PHASE I, procure/modify available antennas or design and fabricate prototypes and mount on full scale mock-up or available V-22 aircraft and perform experimental laboratory cross-coupling tests. Analyze the complete antenna coverage measurements using scale models in appropriate antenna range testing.

PHASE III: This topic has the potential for transition to PHASE III via linkage between the small business and the V-22 prime contractor and/or component suppliers.

N93-247 TITLE: Low-Cost Tow Preg.

CATEGORY: Engineering Development; Composite Materials

OBJECTIVE: To improve method of fabricating epoxy resin tow preg.

DESCRIPTION: The present method of fabricating epoxy resin tow preg. suitable for use on automated fiber tow placement machines is expensive. Unidimensional three-to six-inch wide tape is produced to the required thickness. This is a standard production operation and routinely produces tape at a cost of $60-$70 per pound. The tape is then unreeled and slit to the required width, resulting in an additional cost of $20-$30 per pound (double process). A direct, single-tow process has been demonstrated to produce the required material directly from dry carbon fiber tows. Further development is required, as this process could significantly reduce machine ready tow preg. costs.

PHASE I: Evaluate slitting and single tow prepreg techniques. Optimum resins, processes, and equipment requirements will be evaluated and equipment design will be defined.

PHASE II: Scale-up process to demonstrate reproducibility. In addition, prototype equipment will be fabricated and resin selections and processes will be verified and refined.

PHASE III: This topic has the potential for transition to PHASE III via linkage between the small business and the V-22 prime contractor and/or component suppliers.

N93-248 TITLE: Low-cost Prototype (Composite) Tooling

CATEGORY: Engineering Development; Composite Materials

DESCRIPTION: Current tooling technology used to produced a production run of composite components is expensive ($300/ft^2). One alternative, plastic-faced plaster, is capable of producing a single part, but requires expensive flow-time and frequently fails during autoclave cure. Low-cost resin systems suitable for chapped fiber epoxy layup is one suggested approach.

PHASE I: Examine candidate low cost resins as tools for composite components and metal spray technology.

PHASE II: Fabricate a compound curvature graphite reinforced secondary structural composite component.

PHASE III: This topic has the potential for transition to PHASE III via linkage between the small business and the V-22 prime contractor and/or component suppliers.

N93-249 TITLE: Fabrication of Thermoplastic Secondary Structures for V-22

CATEGORY: Engineering Development; Composite Materials

OBJECTIVE: Evaluation of thermoplastic composite materials and fabrication techniques for V-22 secondary structure.

DESCRIPTION: Thermoplastic composites have shown to be more damage tolerant than thermoset composite materials. Several studies have shown that doors and other secondary aircraft structure can be fabricated from thermoplastic composites at lower cost than from thermoset. This program will evaluate several V-22 structures and demonstrate that they can be manufactured for a lower cost and be more damage tolerant than the thermoset structure.

PHASE I: Perform a trade study to select highest payoff door. Evaluate fabrication methods for door and fabricate a prototype to determine processing conditions, and fabrication techniques.

PHASE II: Test prototype door fabricated PHASE I. Fabricate 5 more doors for flight test and service evaluation. Track fabrication and life cycle costs for doors as well as damage tolerance and inservice experience.

PHASE III: This topic has the potential for transition to PHASE III via linkage between the small business and the V-22 prime contractor and/or component suppliers.

N93-250 TITLE: Woven Structure/Resin Transfer Molding

CATEGORY: Engineering Development; Composite Materials

OBJECTIVE: To develop methods of fabricating complex composite structures, such as the V-22 windshield/canopy frame.

DESCRIPTION: The present V-22 configuration, hot-formed and welded-titanium frame, is heavy and costly. A composite frame utilizing a dry-fiber preform, fabricated by multidimensional weaving or braiding, and resin-impregnated and cured using resin transfer molding, offers promise of reducing both weight and cost.

PHASE I: Study options and select a preform fiber architecture and resin system suitable for this purpose.

PHASE II: Fabricate a prototype RTM V-22 windshield/canopy frame and perform critical structural tests. Prototype fabrication costs will be documented and production processes defined and costs estimated.

PHASE III: This topic has the potential for transition to PHASE III via linkage between the small business and the V-22 prime contractor and/or component suppliers.

N93-251 TITLE: Onboard Electrical Load Management of V-22 Aircraft Power Systems

CATEGORY: Advanced Development

OBJECTIVE: To manage the electrical power available on board the V-22 for efficient allocation during peak demand periods.

DESCRIPTION: Electrical power systems onboard fixed, rotary, and especially Tilt-Rotor aircraft have excessive demands during periods of demand heating to reduce land when operating BW systems. Methods of electrical power management need to be studied for automatically and electronically managing electrical load demands during these periods to avoid designing aircraft power systems to excessive power requirements.

PHASE I: The following studies need to be addressed in the PHASE I program;

a) A review of electrical load power budgets on a system by system by system by system basis to determine possibilities of load shedding during periods of heavy demand, such as wing heating during icing conditions and when operating electronic Warfare Systems.

b) A through review of the reliability of fault tolerant computers/sensors and electrical load circuit breaker actuators used for load shedding.

c) A conceptual design for an electrical load management system, including management system, including proposed loads and conditions for adding, dropping loads, using the V-22 electrical system in airforce variant as a model.

PHASE II: A prototype laboratory system will be developed and tested for PHASE II including components and system design proposed in PHASE I

PHASE III: This topic has the potential for transition to PHASE III via linkage between the small business and the V-22 prime contractor and/or component suppliers.

N93-252 TITLE: Innovative ECM System for Tilt Rotor/Rotary Wing Aircraft

CATEGORY: Advanced Development; Signature Control

OBJECTIVE: Identify and develop innovative concepts for defensive ECM systems for tilt rotor/rotary wing aircraft especially during VERTOL/VSTOL operations.

DESCRIPTION: Typical tilt rotor and rotary wing aircraft designs present large cross-section, slow moving, non-maneuvering targets during the takeoff, landing, and cargo/personnel insertion /extraction portions of their various mission profiles. Such performance profiles put a premium on DECM system performance for aircraft survivability. Conventional ECM solutions usually employ high power jammer and/or threat specific, complex modulation techniques which carry considerable weight and power penalties.
A study should be performed to identify innovative approaches to enhance ECM system performance. Analysis should include evaluation of emerging technologies in such areas as high speed/high power switching devices; low-weight power supplies; and self-tuning, electronically steered phase arrays. Analysis should culminate in the definition of a conceptual design to include performance estimates.

PHASE I: The following elements should be addressed during the PHASE I program.

a) Catalog threat radar characteristics to provide basis for jammer performance characteristics.

b) Determine jammer requirements based upon DECM system antenna design(s), jammer power, modulation, and aircraft RCS Characteristics as well as engagement geometries (aspect angle, intercept ranges, exposure times, etc.).

c) Evaluate emerging technologies for compatibility with DECM system requirements defined above.

d) Develop a conceptual design based upon the selected approach and provide initial system performance estimates.

PHASE II: A prototype, laboratory system will be developed and tested to validate the technology selected.

PHASE III: The topic has the potential for transition to PHASE III via linkage between the small business and the V-22 prime contractor and/or component suppliers.

N93-253 TITLE: Metal Matrix Composite Components

CATEGORY: Advanced Development; Composite Materials

OBJECTIVE: To develop methods of manufacturing low-cost, fiber-reinforced complex structures such as transmission casings or engine compressor disks.

DESCRIPTION: A prototype gear case has been fabricated to demonstrate a direct casting process, but the technology requires further development. However, the process provides increased service life for transmissions by increasing the casing stiffness and decreasing gear and bearing wear.

PHASE I: Study available methods and/or propose a new innovative process and validate by analysis that the process can produce component shapes with acceptable properties.

PHASE II: Fabricate prototype tooling and produce prototype components with acceptable properties and reproducible quality.

PHASE III: This topic has the potential for transition to PHASE III via linkage between the small business and the V-22 prime contractor and/or component suppliers.

N93-254 TITLE: Self-adaptive Notch Filter for the V-22 Flight Controls

CATEGORY: Exploratory Development

OBJECTIVE: To study the feasibility and methods of implementing a self-adaptive notch filter to mitigate unwanted structural modes in the V-22.

DESCRIPTION: On-board digital signal processing (DSP) can be used to identify structural modes by way of existing aircraft sensors. The sensors include the Standard Attitude Heading Reference Systems (SAHRS), VYROS (electronic gyros), cockpit control position sensors, accelerometers, strain gauges, and actuator position sensors. This information is available on the flight control communication busses and within the flight control computers. The DSP would be adaptive in the sense the notch filter would change frequency between pre-determined limits to center on a structural mode. Once identified, the DSP could produce a notch filter to mitigate induced structural modes using the flight controls.

PHASE I: This study will address the feasibility of implementing a self-adaptive notch filter DSP into the V-22 flight controls. A computer based generic aircraft model will be used to demonstrate a self-adaptive notch filter.

PHASE II: 1) Develop a self-adaptive notch filter for the V-22. 2) Demonstrate that the DSP can identify the structural mode while in flight and can create the necessary filter to mitigate the unwanted structural mode (does not implement filter into the flight controls under this SBIR).

PHASE III: This topic has the potential for transition to PHASE III via linkage between the small business and the V-22 prime contractor and/or component suppliers.

N93-255 TITLE: Simplified "Health of the Aircraft" Sensing System

CATEGORY: Advanced Development; Weapons System Environment

OBJECTIVE: To improve methods of detecting weakened structural elements before failure of the aircraft occurs.

DESCRIPTION: There is an urgent need for a reliable aircraft vibration and environmental structural effects detection system to be developed especially for composite aircraft. It is believed that the changes in damping and stiffness can be detected through shifts in the normal modes of vibration of an aircraft structure. An important aspect of the study is to verify that only changes in response need to be determined; the normal modes of a structurally sound aircraft are known from preflight calibration.

PHASE I: A study using the V-22 as a demonstration model will show that by embedding a small number of lightweight sensors inside the aircraft either during manufacture or maintenance, and by employing appropriate data analysis algorithms, it may be possible to detect changes in both structural damping and stiffness during flight. The fact that the changes in damping and stiffness are caused by delamination and are the precursors of structural failure must be studied and shown to be valid assumptions.
The study should address applicability of the method to metal airframes, which are subject to corrosion failure and the delamination of adhesively bonded aluminum components. In addition, the shift in normal modes technique has potential application to detect incipient failure in power transmission gears.

PHASE II: A prototype system as defined in PHASE I will be fabricated and installed in an available V-22 aircraft and flown through appropriate flight conditions.

PHASE III: This topic has the potential for transition to PHASE III via linkage between the small business and the V-22 prime contractor and/or component suppliers.

N93-256 TITLE: CBR Agent Detector for the V-22

CATEGORY: Engineering Development

OBJECTIVE: Develop an Agent Detector for the V-22

DESCRIPTION: Since Chemical-Biological-Radiological (CBR) agent contamination can go undetected both in and out of the aircraft, a detection and warning system for the V-22 is required. The system shall identify any agent contamination in the aircrew breathing system or environmental control system (ECS), and alert the crew.

PHASE I: To develop a concept for a CBR agent detector and warning system that shall identify any agent contamination in the breathing system or ECS. The detector shall identify the agent and concentration and warn the crew when unacceptable levels are reached. Detectors in the cabin and cockpit shall also be required for agent detection in these areas. Exterior detectors shall warn ground and maintenance crew if the aircraft is contaminated.

PHASE II: To fabricate an agent detector and warning system that shall integrate with the V-22 and identify any agent contamination in the breathing or ECS systems.

PHASE III: This topic has the potential for transition to PHASE III via linkage between the small business and the V-22 prime contractor and/or component suppliers.

N93-257TITLE: Agent Decontamination for the V-22

CATEGORY: Engineering Development

OBJECTIVE: Develop CB (chemical/biological) agent decontamination procedures and equipment for the V-22

DESCRIPTION: Following agent contamination, the aircraft must be decontaminated to remove the agent hazard. Procedures and equipment must be developed for safe decontamination of the V-22.

PHASE I: To develop decontamination procedures for both the interior and exterior of the V-22 that shall be effective in removing CB agent, do not damage the equipment, can be accomplished in a reasonable amount of time, and are not cost prohibitive.

PHASE II: To fabricate equipment for the decontamination of the V-22.

PHASE III: This topic has the potential for transition to PHASE III via linkage between the small business and the V-22 prime contractor and/or component suppliers.

N93-258TITLE: Laser Radar for Terrain Following/Terrain Avoidance (TF/TA)

CATEGORY: Advanced Development; Sensitive Radar

OBJECTIVE: A laser radar, with appropriate systems, has the potential for enhancing the tactical effectiveness of the V-22, MH-47E, and HH-60 aircraft by allowing the aircraft to operate at higher speeds, at lower altitudes and in more adverse weather. These features will improve the probability of mission success in SOF operations.

DESCRIPTION: The laser radar will be designed to fit the same mounts as the present microwave radar and offer better performance. The laser radars currently available use a carbon dioxide lasing medium that produces a wavelength of 10.6 microns. Although the lens system may be as large as five inches in diameter, lenses of one-inch diameter are preferred.

PHASE I: To achieve top performance, the following issues must be addressed:
Pointing accuracy and stability of the turret must be able to position the laser within 0.025 milliradian (0.0015 degrees).
The turret speed must be at least able to support a scanning efficiency of 50%. This means that it must be able to shift the beam through an accelerated move and stop cycle within 0.013 milliseconds. This high speed probably means that high sped beam shifts be accomplished optically using, for example, a moving mirror. Larger motions of the beam can be made relatively slowly with a desired rate of 90 degrees per second.
The turret must mount two laser radars that move independently. Both radars must be able to point at all positions over a 20x80 degree field-of-regard.

PHASE II: A prototype/breadboard laser radar system will be developed and tested to verify performance that meets the requirements defined above in PHASE I.

PHASE III: This topic has the potential for transition to PHASE III via linkage between the small business and the V-22 prime contractor and/or component suppliers.

N93-259 TITLE: Composite Cockpit Cage

CATEGORY: Engineering Development; Composite Materials

OBJECTIVE: To provide a lighter less expensive option for the design of the V-22 cockpit cage

DESCRIPTION: The V-22 cockpit cage configuration of heavy titanium, is expensive. Titanium strength and stiffness characteristics can be replicated using composites to provide a cost and weight savings.

PHASE I: A study including a detailed analytical validation of the feasibility of using composite materials in the V-22 cockpit cage. This study must include a recommendation with design and producibility justifications for the material and processes selected.

PHASE II: A prototype structure will be fabricated on soft tooling of similar design to proposed production tooling. Critical structural testing will be completed and reported, with estimated costs per unit using proposed production processes.

PHASE III: This topic has the potential for transition to PHASE III via linkage between the small business and the V-22 prime contractor and/or component suppliers.

N93-260 TITLE: High Temperature Advanced Composite Drive Shafts

CATEGORY: Advanced Development; Composite Materials

OBJECTIVE: Develop a low cost and light weight composite high temperature drive shaft.

DESCRIPTION: Filament wound composite drive shafts are used in the V-22 aircraft at several locations connecting the engines to gear boxes. The loss of the structural integrity of these shafts can result in loss of the aircraft. Current shafts are fabricated from epoxy resin systems vicinity of these components caused by combustible fluids can rapidly seconds. A shaft fabricated from advanced materials is necessary to provide protection to the drive shafts for defined loads, temperatures and durations. The resulting component shall be light weight, low cost and fit within constrained area.

PHASE I: The PHASE I program will develop concepts and preliminary component configurations.

PHASE II: PHASE II will consist of fabrication and test of one or more components.

PHASE III: This topic has the potential for transition to PHASE III via linkage between the small business and the V-22 prime contractor and/or component suppliers.

N93-261 TITLE: Covert Forward Looking Sensor for V-22

CATEGORY: Advanced Development; Sensitive Radar

OBJECTIVE: To define requirements for, develop, and evaluate a covert forward looking sensor that meets, as a minimum, the performance of the AAQ-16B FLIR system.

DESCRIPTION: Currently available forward looking infrared systems are not covert. Terrain following/terrain avoidance (TF/TA) flight regimes for the V-22 would be greatly enhanced if the sensor system could be used for covert missions.

PHASE I: A study will be performed to determine:

1. Performance requirements (per AAQ-16B)
2. Data output required
3. Data output form best suited to V-22

4. Best way of displaying the forward sensor data to the pilot
5. Best way of applying the data to the V-22 flight control system
6. The candidate radar systems that provide a solution to the covert issue and will meet performance requirements
7. The best transmitted waveform to be used for each covert radar system

PHASE II: PHASE II will be a further study to determine from the PHASE I candidates which covert forward looking sensor system will be developed. PHASE II will include a computer model of the selected system to prove the viability of the concept.

PHASE III: This topic has the potential for transition to PHASE III via linkage between the small business and the V-22 prime contractor and/or component suppliers.

N93-262 TITLE: Explosive Sound Source Design Aid

This topic is CANCELLED.

N93-263 TITLE: Variable Coherent Sound Source

CATEGORY: Advanced Development

OBJECTIVE: Provide a variable frequency coherent sound source which is compatible with sonobuoy form, fit and function. The results will help provide the optimum performance for the operation of sonobuoys.

DESCRIPTION: The source must be able to operate satisfactorily at depths between 100 feet and 2500 feet and provide for a variable vertical beam forming capability. It is also desirable that the source sound pressure level be variable, with a nominal 210 db re 1 uPa maximum.

PHASE I: Investigate various techniques, materials and design approaches to determine the feasibility of meeting the objective and document the study effort in a final report.

PHASE II: Develop and fabricate a prototype or prototypes of the source defined in Phase I. Conduct in house testing to validate performance and prepare a plan for conducting sea tests of the source.

PHASE III: Fabricate a test quantity of the sources developed in Phase II and conduct over-the-side type sea tests to characterize the source and validate the performance.

N93-264 TITLE: High-Temperature Self-Lubrication Ceramic Bearings

CATEGORY: Advanced Development

OBJECTIVE: To establish a production process for the manufacture of high-temperature ceramic bearings for use in future aerospace propulsion systems.

DESCRIPTION: Future naval aerospace propulsion systems will require antifriction bearing elements that will sustain high mechanical stress at temperature in the 1500 degree F range. At these temperatures, current bearing materials will soften and not support the load. In addition, currently available lubricants will evaporate, oxidize and thermally degrade. An approach that looks extremely promising incorporates thermally stable solid lubricants as part of the bearing structure. In this fashion, replenishment of the lubricant material will be facilitated by the use of a ceramic self-lubricating retainer which will act as a reservoir for the lubricating solids. The fabrication of this retainer will be critical in achieving the desired lubrication effect in conjunction with other monolithic ceramic components such as balls, rollers, and inner and outer raceways. Hot-vacuum pressing and hot-isostatic pressing are the current methods of producing composite bearing elements. These methods should be explored as potential solutions to this problem.

PHASE I: Demonstrate bearing prototypes and develop plans for process design and specifications.

PHASE II: Develop process design and specification. Develop and build prototype system. Manufacture a quantity of bearings specified by the Navy for testing.

N93-265 TITLE: Fiber-Optically Coupled Laser Beam Forming and Steering Device for Multipurpose Airborne Laser Application

CATEGORY: Exploratory Development; Photonics

OBJECTIVE: Develop an electro-optomechanical device that is fiber-optically coupled to a dual laser system mounted internal to an airframe, is capable of steering laser output beams to any point within a +5 degrees, -90 degrees elevation by +/-60 degrees azimuth field-of-regard forward of the aircraft and simultaneously provides the means to receive laser return signals and spread the output beam over an adjustable range of beam divergence values from several degrees to a few milliradians.

DESCRIPTION: Current trends are to develop a separate laser system to perform a specific function: wire obstacle avoidance, velicometry, covert communications, landing zone illumination or countermeasures. This work would provide a laser beam forming and steering device that would integrate several laser-based functions within an airframe and significantly reduce the size/weight penalties imposed by the installation of separate, single function laser systems. It would also eliminate the need for a costly four-axis, servomechanically-driven gimbal platform to steer laser outputs, and provide the technology base for the potential development of a multi-purpose laser system requiring only two lasers mounted internal to the aircraft with outputs fiber-optically coupled to selected points along the airframe.

PHASE I: Identify the design of a novel laser beam forming and steering device based on fiber-optic, binary and microlens, and advanced optical technologies and component integration technologies. Perform an analytical study to define component performance and design requirements, component optical and electronic integration, and assessment of projected beam forming and steering capabilities.

PHASE II: A prototype device, based on an approved Phase I design, will be assembled and tested using low-power lasers provided as government furnished equipment and operating at select wavelengths in the 0.5 to 5 um range. Final deliverables will be a working laser beam forming and steering device and laboratory evaluation report.

PHASE III: Potential use to Navy, Air Force, or FAA

N93-266 TITLE: High Speed Low-power Optical Receiver with Clock Recovery for Digital Communications

CATEGORY: Exploratory Development; Photonics

OBJECTIVE: Develop a high speed compact low-power optical receiver with clock recovery circuit for use in military local area networks.

DESCRIPTION: Advance avionics architectures will feature Local Area Networks which operate at serial data rates in excess of 1 gigabit per second. Optical receivers and clock recovery circuits which operate at these speeds tend to be bulky and power-hungry, making them unsuitable for the avionics environment. The purpose of this effort is to develop a high speed, compact, low-power receiver with clock recovery suitable for operation in a military environment.

The optical receiver and clock recovery should operate at a wavelength of 1300 nanometers at speeds in the range of 1 to 2 miliwatts and supply voltages should be +/- 5 Volts. Total device dimensions should not exceed .25 x .25 x 0.1 inches. The data and recovered clock outputs of the receiver/clock recovery should be compatible with Emitter-Coupled Logic levels. Acquisition time for the clock recovery should be less than 1 microsecond and the capture range should be 100 megaHertz.

Initially the operating temperature should cover the range 0-85 Celsius with an ultimate goal of the full military temperature range. Techniques which may be considered may include but are not limited to phase-locked loops, dielectric resonators, or bulk acoustic resonators.

PHASE I: Show technical feasibility of conceptual receiver/clock recovery circuit.

PHASE II: Development of the receiver/clock recovery circuit.

N93-267 TITLE: High Density Power Amplifier for Low Frequency Active Sonobuoys

CATEGORY: Exploratory Development; Semiconductors

OBJECTIVE: Develop a high power, low frequency, high density power amplifier for use in an "A" size Active sonobuoy.

DESCRIPTION: Perform the engineering analysis, design, and development of a prototype high density power amplifier system necessary to integrate with an existing acoustic projector system for concept demonstration testing.

PHASE I: Perform an engineering analysis of the power amplifier electrical and mechanical design requirements, develop several candidate conceptual designs and recommend the most promising one for Phase II.

PHASE II: Design, fabricate, and test one or more high density power amplifiers capable of driving an acoustic projector.

PHASE III: Interface the high density power amplifier with a specified lithium thermal battery and acoustic projector. Conduct an engineering demonstration test of these subassemblies.

N93-268 TITLE: Loading System for Nondestructive Testing

CATEGORY: Exploratory Development; In-situ Evaluation

OBJECTIVE: To develop an innovative loading system that can be used in conjunction with nondestructive testing methods such as shear holography and acoustic emission, that require or could benefit from loading of parts during their use.

DESCRIPTION: The Navy has critical needs for simple nondestructive testing methods for rapidly testing aircraft components. A number of advanced techniques such as acoustic emission, thermography, and holography have the potential to test large area structures in a short period of time, provided that a uniform well characterized reproducible loads can be applied to them. Other techniques such as ultrasonic inspection, eddy current inspection and even radiography could be made much more sensitive provided the correct type of loading could be applied to open cracks during use. These testing methods could be applied to finding defects in a wide variety of aircraft components including cracks in metal bulkheads, delaminations in composite wing skins, cracks in turbine blades and disks and cracks in landing gear.
The most desirable loading technique would be portable, repeatable, quickly applicable to structures of varying shapes and sizes, would not obstruct access to the structure and would not damage it. Methods that have been tried for this purpose in the past have involved vacuum loading, thermal loading, sonic loading and impacting of the structure.

PHASE I: Develop the loading concept and perform laboratory demonstration of its feasibility.

PHASE II: Build a fieldable working model and demonstrate it with appropriate NDI techniques on real structures or components.

PHASE III: Application of device to inspection of critical aircraft components inspected by NADEP's.

N93-269 TITLE: Machinability of AF 1410 and AerMet 100 High Strength Steels

CATEGORY: Advanced Development; Flexible Manufacturing

OBJECTIVE: To determine quantitative machinability data in order to establish optimum tool life in machining of AF 1410 and AerMet 100 steels.

DESCRIPTION: Currently used ultra-high strength steels for such applications as aircraft landing gears are flaw sensitive and subject to hydrogen embrittlement and stress corrosion cracking. AF 1410 and AerMet 100 steels

offer improved fracture toughness and stress corrosion cracking resistance but their machinability parameters are not well established. Use of less than optimum machining parameters contributes to increased cost and discourages application of these otherwise beneficial high strength steels. Accurate machinability data is required to achieve optimized productivity at minimum cost in the production of naval aircraft landing gear components.

PHASE I: Should consist of a study outlining the approach and determining feasibility of quantifying the machining characteristics of AF 1410 and AerMet 100 steels by determination of tool life characteristics for each type of machining operation.

PHASE II: Entails the determination of optimum tool speed/work piece feed rates which result in minimum tool wear. Tests should include cutting force evaluations, determination of power consumption rates and characteristics of work piece surface finish. Metal cutting and rough machining operations shall be performed on the steels in the overaged (minimum hardness) condition. Finish machining operations shall be performed on the steels in the hardened and aged (maximum hardness) condition. Determination of the parameters associated with cutting, boring, drilling, grinding, milling, reaming, tapping, thread grinding and turning shall be included. Data shall be presented in handbook form.

N93-270 TITLE: Compact Tunable Optical Filter for Fiber Optic Communications

CATEGORY: Exploratory Development; Communications

OBJECTIVE: Develop a compact tunable optical filter for wavelength division demultiplexing in military local area networks.

DESCRIPTION: There is increasing interest in the use of wavelength division multiplexing to increase the bandwidth and connectivity in advanced military local area networks. This interest has resulted in a need for compact wavelength division demultiplexers which are compatible with the size and power requirements of typical fiber optic systems.

The purpose of this effort is to develop a compact tunable optical filter for wavelength division demultiplexing in fiber optic communication systems. The filter should cover the spectral range from 0.8 - 1.6 microns with 1 nanometer accuracy and resolution and 120 nonometer resolution (full width at half maximum). Transmission at the selected wavelength should be at least 50% and extinction outside the passband should be at least - 30 decibels. The insertion loss of the device should be less than -3 decibels. Tuning speed should be at least 0.1 microns per microsecond. Size and power requirements should be compatible with typical fiber optic systems used in military applications (1" x 1" x 0.125" in size, less than 20 Volts peak operating voltage). Initially the device should operate over the commercial temperature range with the ultimate goal of operation over the full military temperature range.

PHASE I: Show technical feasibility of the device.

PHASE II: Prototype development.

N93-271 TITLE: Genetic Algorithms for Flight Control Optimization

CATEGORY: Exploratory Development; Machine Intelligence/Robotics

OBJECTIVE: To develop and demonstrate the use of genetic algorithms for flight control optimization in either the design process or through on-line learning.

DESCRIPTION: Genetic algorithms have recently been demonstrated to have strong potential for improving control systems through design optimization or on-line learning. For flight control, genetic algorithms may be used to optimize either inner loop tasks such as primary command and stability augmentation or outer loop tasks such as automated trajectory control for weapons delivery or terrain following/terrain avoidance. In the case of an inner loop controller, the genetic algorithm optimization must supply acceptable pilot handling qualities. In all cases, the proposed use of genetic algorithms must be sensitive to real-world implementation issues such as validation and computational overhead.

PHASE I: The proposed genetic algorithm learning methodology should be demonstrated on a flight control system element of a simplified high performance aircraft model.

PHASE II: The genetic algorithm technique developed in Phase I will be demonstrated on a medium fidelity nonlinear aircraft model with sufficient complexity for a proof-of-concept. This aircraft model should include instabilities, disturbances, sensor noise, and uncertainties in plant dynamics.

NAVAL AIR WARFARE CENTER/TRENTON

N93-272 TITLE: Powder-Metallurgy Net-Shape Process

CATEGORY: Exploratory Development

OBJECTIVE: To investigate and develop a unique specialty metal-alloy powder process that consolidates and forms a near-net-shape preform product and to provide a single low-cost densification process which uses conventional forging presses instead of hot isostatic pressing.

DESCRIPTION: Current Navy turbine engine components produced as forgings are expensive because they require extensive machining. Much of the material is lost in machining because it cannot be disposed of due to environmental reasons. Foreign sources are now being utilized for critical strategic materials such as cobalt, chromium, tantalum, and rhenium. A potential solution to this problem is to develop a low-cost, net-shape, powder metallurgy process that can produce alloys and composites that meet the stringent requirements of today's advanced aerospace engines.

PHASE I: Develop a process using powder metallurgy with the capability to build high-performance static-vane engine components. The deliverable for this phase will be the identification of the powder metallurgy process, the process specification, and the hardware and software designs. An example process is sintering.

PHASE II: Develop and build a prototype system. Produce quantity of static vane engine components specified by the Navy for testing.

N93-273 TITLE: Lightweight, Active Noise Suppression for Small Diesel Engines

CATEGORY: Exploratory Development; Air-Breathing Propulsion

OBJECTIVE: Demonstrate the feasibility of a lightweight, active noise reduction system.

DESCRIPTION: The Navy is seeking an active noise suppression system for use on small, high speed, two and four stroke diesel engines (reciprocating and rotary) which provide propulsion power for unmanned aerial vehicles (UAVs). this system should be simple, lightweight and consume minimal electrical power from an engine driven 23 VDC alternator/generator. The system will be self contained, be mounted on the engine, and shall have minimal effects on the aerial vehicle's airframe and aerodynamics. Its weight should be comparable to the exhaust system of a 50 horsepower motorcycle engine. The active noise suppression system shall not cause any reduction of power from the engine and shall function from idle to maximum (8000 RPM) engine shaft speed. The engine shall be inaudible in all possible ambient conditions from 1000 to 12,000 feet altitude.

PHASE I: Phase I shall demonstrate system effectiveness on a reproduction of an engine noise signature with varying RPMs. It will also provide an analysis of Phase II system design which demonstrates weight, performance and packaging goals.

PHASE II: Phase II will build and demonstrate on a Navy selected UAV engine the system which meets the Phase I goals.

PHASE III: Phase III would require a team arrangement with a UAV airframer to design and incorporate the active noise suppression system into air vehicles.

N93-274 TITLE: Innovative Lightweight Hybrid Diesel/Electric Propulsion System for Unmanned Air Vehicles (UAV)

CATEGORY: Exploratory Development; Air-Breathing Propulsion

OBJECTIVE: To perform a feasibility and tradeoff study necessary to characterize a hybrid propulsion system for unmanned air vehicle airframe system.

DESCRIPTION: The Navy currently uses propulsion systems for unmanned air vehicles that are based on either reciprocating or turbine engines that deliver shaft horsepower to a propeller or rotor system. Typically this propulsion system includes a fuel tank and speed reduction gearboxes. For long duration, high altitude air vehicles it may be desirable to replace or supplement the current configuration of components with a hybrid diesel/electric propulsion system which could incorporate solar energy, along with a diesel powered generator set, to provide flight time of weeks and months in duration. This system will have a reusable energy source and a variable speed electric drive along with a generator set to replace or supplement an engine and gearbox. Typically these systems would require peak power during approximately 20 percent of the total operating time, with the remainder of the mission (loiter) requiring 50 percent of the peak power. Nominal values for a mission length of two weeks, and 100 percent peak horsepower, should be used, though operational systems requiring 500 horsepower should be considered. Altitudes above 50,000 feet should be examined for loiter conditions. The study should provide a design concept, with all of the tradeoffs detailed, along with scaling for both greater horsepower and mission duration.

PHASE I: Phase I would generate conceptual designs which would be validated through theory and analysis, and all of the tradeoffs required to justify the concepts.

PHASE II: Phase II would consist of fabrication of subscale proof of concept designs and experimental verification of the approach.

PHASE III: Phase III would require a team arrangement with a UAV airframer to design and build demonstration air vehicles.

N93-275 TITLE: High Speed and Temperature Counter-Rotating Intershaft Seals for Aviation Turbine Engines

CATEGORY: Exploratory Development; Air Breathing Propulsion

OBJECTIVE: To design, fabricate and demonstrate an intershaft sump seal capable of full life operation at conditions required by advanced counter-rotating engines (1200 feet per second surface velocity, 1000□F air, 50 psid).

DESCRIPTION: Advanced aviation turbine engines will use counter-rotating rotors to achieve target performance levels. This design approach imposes significant challenges in the area of sump sealing, specifically in the intershaft region. Counter-rotation effectively doubles the imposed relative surface velocities for intershaft seals, which results in unacceptably low life with current design approaches. Innovative technological solutions to this challenge are sought for exploitation in a design, fabrication and demonstration type effort. Target operational conditions for the developed seal(s) include 1200 fps surface velocity, 1000□F air, and approximately 50 psid differential pressure. Seal life goal is 4000 hours.

PHASE I: Phase I would compete candidate seal concepts, refine operational requirements in the context of an advanced demonstrator engine, provide a detailed design suitable for fabrication, and provide a test and evaluation plan for the candidate seal.

PHASE II: Phase II would consist of fabrication of one or more candidate seal designs (engine quality hardware), and performance of 25 hours of operability testing and 200 hours of endurance testing at simulated mission conditions.

PHASE III: Design, fabrication, and demonstration on a full scale engine.

N93-276 TITLE: Next Generation Electrochemical Machining (ECM) Electrolytes

CATEGORY: Exploratory Development; Air Breathing Propulsion

OBJECTIVE: Apply new/advanced electrolytes in ECM technology to achieve significantly increased material removal rates, increased precision, improved surface finish, lower power consumption and improved environmental compatibility for use on advanced gas turbine propulsion materials.

DESCRIPTION: Electrochemical machining is a relatively nontraditional process based on controlled removal of material by electrolytic dissolution of the work piece. Electrolytes are normally aqueous solution of salts or may be strong hydroxides for use in select metals. Electrolytes have several proposes: a) carry the electric current between the tool and workpiece, b) heat removal and c) remove reaction products from the cutting region. Until recently, there has been a general lack of scientific understanding of the workpiece/electrolyte interface phenomena. This leads to diverse applications which are conducted under a single basic ECM process, using similar electrolytes and power process controls. Proposals are sought to investigate the use of advanced electrolytes systems (such as, but not limited to, molten salts or molten bases) as they apply to various advanced gas turbine propulsion materials. Develop analytical projections for test removal rates, precision, surface finish and anticipated improvements for advanced metal alloys, ceramics and metal matrix composites used in aircraft jet engines.

PHASE I: Phase I would identify various electrolytes and demonstrate the advantages of each electrolyte for feasibility of its removal rate on a selected advanced material, its industrial application and cost-effective use. Identify associated operation and maintenance requirements.

PHASE II: Phase II would develop, build and test a prototype ECM system capable of processing full-scale engine hardware. Demonstrate and optimize system parameters for use on selected advanced metal alloys, ceramics and metal matrix composites.

PHASE III: Navy funding to transition this technology is contingent on the quality of PHASE II results.

N93-277 TITLE: Innovative and Durable Flexible Shafts For Power Transmission In Unmanned Air Vehicle Propulsion Systems

CATEGORY: Exploratory Development; Air Breathing Propulsion

OBJECTIVE: To develop a durable flexible drive shaft for transmission of engine shaft horsepower to remote locations within an unmanned air vehicle airframe.

DESCRIPTION: The Navy is developing propulsion systems for unmanned air vehicles which may require shaft horsepower to be transmitted within an air vehicle. Typically this is done with shafts and turning gear boxes. The Navy desires to replace this technology with flexible drive shafts which should reduce weight and complexity while increasing reliability. The shaft design should consider horsepower ranges from 100 to 300 horsepower. Also the design should minimize both whirl of the shaft between supporting points and shaft wind-up. A single shaft should be capable of transmitting power through three 90 degree angles simultaneously at a radius not to exceed 12 inches, and performing for 100 hours without failure.

PHASE I: Phase I would generate conceptual designs which would be validated through theory and subscale prototype testing analysis, and

PHASE II: Phase II would consist of fabrication of subscale proof of concept designs and experimental verification of the approach.

PHASE III: Phase III would require a team arrangement with a UAV airframer to design and build demonstration air vehicles utilizing these drive shafts.

N93-278 TITLE: Performance Optimizing Full Authority Digital Electronic Control (FADEC) for High Speed Spark Assisted Diesel Engines

CATEGORY: Exploratory Development; Air Breathing Propulsion

OBJECTIVE: To develop a software and brassboard model of a real-time, optimizing control for high-speed, spark assisted diesel engines.

DESCRIPTION: The Navy is developing small lightweight intermittent combustion engines (reciprocating, rotary) for use in unmanned air vehicles. To maximize engine performance at all ambient environmental operating conditions it is desirable to utilize a digital fuel controller. These spark assisted diesels typically are designed for sea level conditions, resulting in engine performance at altitude and other ambient conditions that is less than ideal. An engine controller which responds to ambient temperature, pressure and humidity conditions to optimize performance is very desirable. Engine control parameters are typically ignition and fuel injector timing, and fuel injector duration (multiple injectors) to optimize combustion chamber performance. Optimal performance could be based on peak cylinder/rotor pressure and crankshaft speed for a commanded throttle/airspeed setting. Control input and outputs should be based on standard 0-5 vdc and/or milliamp signals. Central processing unit hardware should be constrained to current non-development items.

PHASE I: Phase I would be a feasibility study, software model and brassboard that includes timing descriptions which would be validated through theory and simulation testing.

PHASE II: Phase II would consist of fabrication of pre-production hardware/software which is suitable for use on UAV diesel engines flight engines.

PHASE III: Phase III would require a team arrangement with an engine manufacturer to build engines utilizing this FADEC.

NAVAL AIR WARFARE CENTER/INDIANAPOLIS

N93-279 TITLE: Embedded GPS Requirements (EGR) Compliant GPS

CATEGORY: Engineering Development; Sensitive Radar

OBJECTIVE: To improve overall Global Positioning System (GPS) effectiveness, increase reliability and maintainability, reduce overall life-cycle cost, and improve operational capability of the V-22 aircraft.

DESCRIPTION: A compliant GPS unit per NAVAIR standards {Embedded Global Positioning Requirements (EGR)} does not exist at this time.

PHASE I: The study will define a design and investigate the benefits of embedding a totally EGR-compliant six-channel minimum GPS unit into a possible host system in major areas.
System Total Weight - All possible host GFEs and embeddable GPS will be investigated considering an aircraft hold-down structure, the unit in weight and size, and installation cable size, and installation cable size and weight. The target weight reduction will be no less than 25 percent.
Life-Cycle Cost - A top-level cost analysis will include all associated cost and cost-drivers. The embeddable GPS receiver should require only minimal sensor input for external data sources to prepare for integration. The cost analysis will include non-recurring, recurring, and out-year funding requirements. The target cost savings will be at least 25 percent in overall program costs.
Total Volume Consumption - Investigate off-the-shelf embeddable GPS receivers and possible host systems for form and fit compatibility.
Performance - A top-level performance analysis will measure performance improvement of the embedded systems, host systems, and avionic subsystems.

PHASE II: A prototype NAVAIR EGR compliant Gps will be selected and/or developed and embedded in a host avionics unit and flown in actual aircraft to prove performance.

PHASE III: This topic has the potential for transition to PHASE III via linkage between the small business and the V-22 prime contractor and/or component suppliers.

NAVAL SURFACE WARFARE CENTER/DAHLGREN - WHITE OAK

N93-280 TITLE: Significance of Ultrasonic Detected Defects in Composites

CATEGORY: Exploratory Development; Composite Materials

OBJECTIVE: Develop Mathematical Analysis for Assessing the Significance of Defects in Composites Detected Ultrasonically.

DESCRIPTION: Anomalies and defects are sometimes present in glass and graphite fiber reinforced composites. These are typically detected by a variety of ultrasonic nondestructive evaluation techniques. In order to assess the mechanical significance of such detected anomalies, mathematical analysis must be performed, taking into consideration the interaction of ultrasound with assumed defect geometry and the intrinsic microstructure of the composite. Such analysis for the significance of defects are needed for cylinders, domes, shafts, and other geometrics to assist the development of ultrasonic nondestructive evaluation technology.

PHASE I: Proposer must show the foundation of analysis that can be realistically implemented in immersion ultrasonic testing environment, and discuss the implication of such detected defects when the composite article is under various mechanical and thermal loading environment.

PHASE II: Full scale analysis and software development. Fabrication of defect standards. Implementation of analysis in a commercially available ultrasonic testing system. Delivery of software and ultrasonic testing system to the Navy.

PHASE III: This topic has the potential for transition to PHASE III via linkage between the small business and the V-22 prime contractor and/or component suppliers.

NAVAL AIR WARFARE CENTER/PATUXENT RIVER

N93-281 TITLE: Ice Impact Protection for Thin Skin Composite Laminates

CATEGORY: Exploratory Development; Composite Materials

OBJECTIVE: To improve the resistance of thin skin composite laminates to impact from ice shards shed from proprotor blades.

DESCRIPTION: The current V-22 design will be exposed to severe icing conditions that will likely result in ice shard being shed and propelled at high velocity (300 to 500 knots) from the rotor blades, obliquely striking localized portions of the thin fuselage side wall skins. The impact resistance of the current post-buckled FSD skin design has been judged insufficient to ensure structural integrity and limit damage. The current V-22 design is extremely weight-critical and cannot tolerate a significant thickening of the skin to provide the needed impact resistance. Therefore, a development program is required to define, analyze, design, fabricate and evaluate a weight and cost efficient structural concept which incorporates commercially available energy absorbing, environmentally resistant materials to vastly improve the impact resistance of the sidewall skins.

PHASE I: Define, analyze and design several efficient structural concepts, selecting at least two for fabrication of representative lightweight fuselage skin laminates for use in coupon compression testing after impact with ice shards.

PHASE II: Design, analyze, fabricate and structurally test several V-22 representative integrally stiffened sidewall skin compression and shear panels.

PHASE III: This topic has the potential for transition to PHASE III via linkage between the small business and the V-22 prime contractor and/or component suppliers.

N93-282 TITLE: Sensors for Icing Avoidance, Detection and Accretion Measurement

CATEGORY: Advanced Development; Sensitive Radar

OBJECTIVE: To design a sensor system that will detect the onset of icing conditions and to provide a quantitative estimate of the rate and degree of icing in tilt-rotor aircraft. The selected approach should accommodate the unique flight surface configurations of present-day aircraft and thus minimize the impact on the structural and aerodynamic features of the airframe design.

DESCRIPTION: A study for reliability detecting the aeration of ice on fixed wing, rotary wing, and tilt-rotor aircraft without protrusive elements on the aircraft surfaces does not exist. A system is urgently needed that is not damaged by cleaning or painting processes and for which the sensors do not penetrate or protrude above the wing and flight control surfaces.

PHASE I: To fully exploit the adverse weather potential of the current and future tilt-rotor aircraft, the means of in-flight prediction of the onset, initiation, and degree of ice accretion is desired. Since the tilt-rotor aircraft concept utilizes both rotary-and fixed-wing aircraft flight modes, the icing sensor system should effectively monitor both modes of operation. Preference would be given to approaches that minimize the impact on the mechanical and electrical integration with flight surfaces, rotor drive, tilt mechanisms and the pressure vessel. PHASE I should use the MV-22 Osprey aircraft as the aircraft model for the conceptualization of the sensor system. It is expected that this phase would include the following activities.

- A survey of existing and new technologies applicable to the study.
- Selection of the most promising technology or combination of technologies as the basis for the study.
- A conceptual design based upon the selected approach.
- Prediction of performance of the conceptual design and development.
- A proposal follow-on program during PHASE II which would validate the technology selected and reduce the risk of a development and demonstration of an experimental prototype sensor system.

PHASE II: PHASE II will involve the design development of the technology recommended in the PHASE I study, fabrication of a prototype system, installation of an available aircraft and demonstration/testing in an environmental lab.

PHASE III: This topic has the potential for transition to PHASE III via linkage between the small business and the V-22 prime contractor and/or component suppliers.

N93-283 TITLE: Flight Test Instrumentation to Measure Rotor System Motion and Loads in Navy Helicopters

CATEGORY: Advanced Development; Composite Materials

OBJECTIVE: Develop flight test instrumentation to be used by government test activities to measure the individual main rotor blade motion and blade loads for rotorcraft.

DESCRIPTION: Helicopter flight trainers are starting to incorporate blade element rotor models to achieve a higher level of flight fidelity. This new generation of operational flight trainers (OFT) and weapon systems trainers (WST) will require helicopter blade motion and load data for validation testing. H-60 helicopter blade motion sensor instrumentation is not available at government test facilities like NAWCAD Pax River. A recent HH-60J program was forced to change the proposed blade element rotor model simulator to a rotor map model when it was discovered that instrumentation was not available to measure blade motion in the flight test data program. Blade motion instrumentation are required to independently measure rotor flapping, feathering, and lagging motions. The minimum instrumentation to get rotor blade loads for simulator model validation should also be determined.

PHASE I: Review all previous rotor blade instrumentation installations. Design blade motion sensors that could be used to measure individual axis rotor blade motion during a typical flight test program for a specified aircraft. Propose the minimum instrumentation to get rotor blade loads for blade element simulator model validation. Perform a failure and reliability analysis for the proposed instrumentation.

PHASE II: Develop the instrumentation systems. Support instrumentation installation and calibration on a specified rotorcraft at NAWCAD. Support a flight test program at NAWCAD.

PHASE III: A successful Phase II effort will result in an improved test capability and should generate interest for follow-on Phase III work.

N93-284 TITLE: Real Time Simulation Aerodynamic Updates for Flight Test Support

CATEGORY: Exploratory Development; Simulation and Modeling

OBJECTIVE: To decrease the time it takes to complete a flight test program by improving the use of simulation in the flight phases of the aircraft acquisition process through development of an expert system for real time aerodynamic analysis of flight test data.

DESCRIPTION: Simulation has become a critical technology in the development of aircraft as the basis for design decisions and for use in envelope expansion. The use of aerodynamic simulation to support this process is hampered by the amount of time it takes to keep a simulation current during the flight test development of an aircraft. Analysis of flight test data to estimate linear and nonlinear aerodynamic characteristics to update simulation data is a well established technology; however, accomplishment of this analysis for large quantities of data currently takes from weeks to months to complete. Real time estimation of linear and nonlinear aerodynamics from flight test data and subsequent updating of simulation parameters would have a significant effect on the productivity, cost and time it takes to complete a flight test program. This will be accomplished by improving simulation fidelity though the utilization of multiple system identification technologies integrated together within an expert system for aerodynamic analysis of flight data.

PHASE I: This phase will consist of a conceptual study into the application of expert system technology for automating the aerodynamic system identification process. Next a specification will be written for development of an expert system that utilizes advanced system identification techniques for linear and nonlinear estimation of aircraft aerodynamics and other simulation modeling parameters.

PHASE II: This phase will develop a computer work station using expert system technology capable of real time analysis of aircraft aerodynamics characteristics from flight test data. This work station will provide the capability of automatically integrating estimation results into the simulation data used for real time simulations in piloted simulation facilities.

PHASE III: This technology will transition to support Navy funded programs for the development of the AX, F-18 E/F and V-22 aircraft.

N93-285 TITLE: Ship Based Helicopter Position/Motion Resolving Instrumentation System

CATEGORY: Engineering Development; Weapon System Environment

OBJECTIVE: Develop a ship based instrumentation system to resolve an approaching helicopter's position, rates, and accelerations with respect to an earth fixed and ship fixed coordinate system.

DESCRIPTION: The portable system will be used in conjunction with the ship-helo combination being tested. It should be compatible with ship power, ship electromagnetic environment, and atmospheric environment. The operating system should not adversely affect the aircraft, aircrew, ship or ship's crew. It should also be light weight and man transportable for remote site aircraft/ship testing. The system should be able to determine the helicopter's approach path to the flight deck, its touch down point with respect to a predetermined reference point, and the departure path. The system should be able to accommodate a variety of flight decks, from frigate to LHA class ships. The parameters describing the above should include but are not limited to accelerations, rates, positions, and attitude. A video record of the landing should be recorded concurrently. Recorded views should include the approach stabilized w.r.t. horizon, and the touchdown w.r.t. flight deck. A time synchronization of the data replay and the video should be possible. The test department has a ship motion instrumentation package that stores data in an IEEE format. Helicopter/ship tests last 1-2 weeks, with approximately 6 hours of flight testing per day. Large amounts of data storage capability is required. The instrumentation software should be user friendly menu-driven, and IBM PC based. The option of real time data review should be available.

PHASE I: Develop a preliminary instrumentation system design. Also identify required sensors to support the aircraft motion sensing.

PHASE II: Complete the instrumentation system design. Build the instrumentations system, in accordance with applicable MIL STDS, and acquire aircraft motion sensor system. Demonstrate system operations and check-out at the Naval Air Warfare Center Aircraft Division (NAWC AD). Also demonstrate system operation and check-out during an NAWC AD helicopter/ship at-sea Dynamic Interface (DI) test. Evaluate compliance with stated objectives. Provide complete documentation and user instructions for the ship instrumentation system and associated sensors.

PHASE III: A funded Phase III effort is anticipated to apply the program results to commercial helicopter/ship operations.

N93-286 TITLE: Flight Test Instrumentation to Measure Rotor System Motion and Loads in Navy Helicopters

CATEGORY: Advanced Development; Composite Materials

OBJECTIVE: Develop flight test instrumentation to be used by government test activities to measure the individual main rotor blade motion and blade loads for rotorcraft.

DESCRIPTION: Helicopter flight model when it was discovered that instrumentation was not available to measure blade motion in the flight test data program. Blade motion instrumentation are required to independently measure rotor flapping, feathering, and lagging motions. The minimum instrumentation to get rotor blade loads for simulator model validation should also be determined.

PHASE I: Review all previous rotor blade instrumentation installations. Design blade motion sensors that could be used to measure individual axis rotor blade motion during a typical flight test program for a specified aircraft. Propose the minimum instrumentation to get rotor blade loads for blade element simulator model validation. Perform a failure and reliability analysis for the proposed instrumentation.

PHASE II: Develop the instrumentation systems. Support instrumentation installation and calibration on a specified rotorcraft at NAWCAD. Support a flight test program at NAWCAD.

PHASE III: A successful Phase II effort will result in an improved test capability and should generate interest for follow-on Phase III work from the major helicopter manufacturers/testers.

N93-287 TITLE: Variable Twist Rotor Blade to Optimize Tilt Rotor Aircraft Performance

CATEGORY: Exploratory Development; Simulation and Modeling

OBJECTIVE: Design, analyze, and simulate a variable twist rotor blade system that could be used to help optimize the performance of a tilt rotor aircraft like the V-22.

DESCRIPTION: Tilt rotor aircraft, like the V-22, are required to operate in flight conditions ranging from hover and low speed to high speed cruise. It is not possible optimize the performance of a tilt rotor aircraft by using rotor blades with a set amount of twist. The ideal amount of blade twist will vary from hover to forward flight. Without variable twist rotor blades it will not be possible to optimize the performance of a tilt rotor aircraft like the V-22 for both hover and forward flight.

PHASE I: Design a variable twist rotor system that could be used to help optimize the performance of a tilt rotor aircraft like the V-22. The blade twist should be controllable in flight as a function of flight condition. Conduct a preliminary analysis of the variable twist rotor system.

PHASE II: Conduct/support non-real time and real time simulations comparing the variable twist rotor system to the current V-22 rotor system. Also, evaluate the rotor system aerodynamic, stability, controllability, and elastic characteristics. The simulator and simulation model structure to be used in this program will be specified by the Navy.

PHASE III: If Phase I and Phase II are successful, the Phase III effort would involve developing scale models for wind tunnel testing and conducting whirl stand testing of prototype blades. Interest from potential commercial tilt rotor manufacturers would be high since optimum tilt rotor performance is required for commercial applications.

NAVAL RESEARCH LABORATORY

N93-288 TITLE: Rapid Prototyping and Simulation with Programmable Gate Arrays

CATEGORY: Exploratory Development

OBJECTIVE: To demonstrate the feasibility of rapidly determining whether or not a processor design is suitable, from a performance perspective, for its intended application. Related to this is the demonstration of the feasibility of rapidly constructing an operational piece of hardware that implements the functionality of the processor of interest, that performs adequately from a real time perspective, and that can be electrically connected to other hardware elements with which the processor is operationally integrated. In short, it is the problem of rapidly constructing a physically realized hardware prototype.

DESCRIPTION: Programmable gate arrays are a component technology that is potentially very useful in solving rapid prototyping problems. The technology provides a programmable hardware element that could be made to represent essentially any arbitrarily complex digital circuit. The individual gate array circuits are VLSI devices and contain several thousand gates each, organized into hundreds of configurable logic blocks. It is a very flexible, potentially useful technology. Recent activities towards the exploitation of this technology have focused on the problem of providing `arrays of programmable gate arrays'; that is, the focus is on the problem of interconnecting the gate arrays in networks, so that one could map very large digital circuits onto the network. This will eliminate the fairly severe limitations on the utility of the technology, when applied one device at a time, and open the doors to the possibility of processor rapid prototyping.

The proposed solution to the processor rapid prototyping problem brings together two technologies in an eminently synergistic manner. The first is the Programmable Gate Array (PGA) circuit technology; the second is the JRS Integrated Design Automation System (IDAS) technology. PGA technology is being pursued by constructing large arrays of the devices, that will provide between 500,000 and 1,000,000 equivalent gates or 10,000 to 20,000 configurable logic blocks, that can be automatically configured to represent complex processors. This size array can be packaged onto one VME size board that plugs directly into the backplane of an appropriate host (e.g., SUN). The PGA board can then be driven by the host processor; it can be configured by it; it can receive static or dynamic input data from it; and, it can return output data to it, statically or dynamically. The host processor provides the

environment for testing a prototype, for doing an evaluation of its suitability or comparative effectiveness. The PGA board becomes a hardware simulator/emulator of the target processor; it provides the test bed for testing and evaluating alternatives. The PGA board can then be the actual physical hardware prototype or the configuration data can be transferred to other physical instantiations that might be more useful in a particular system environment. IDAS technology provides the processor synthesis tools and the links to designers working in VHDL that are necessary to effectively utilize the potential of the PGA board in a significant manner.
Processor synthesis in IDAS creates processor representations that are implemented in components contained in libraries and are expressible in VHDL. The VHDL description is then processed to generate a software simulator for the implemented processor. One will then be able to use IDAS to synthesize application specific processors, simulate and evaluate them very fast on the PGA Board, and return results to designers. The configured PGA Board, or a translated image of it, could also be used as a physical prototype for actual interconnection to other hardware such as the backplane of the AN/UYS-2.

PHASE I: Construct 500,000 to 1,000,000 equivalent gates array packaged onto one VME size board that plugs directly into the backplane of an appropriate host (e.g., SUN). Configure and produce software on the host processor to provides the environment for testing a prototype, for doing an evaluation of its suitability or comparative effectiveness.

PHASE II: Utilize the IDAS technology to provide the processor synthesis tools and the links to designers working in VHDL that are necessary to effectively utilize the potential of the PGA board in a significant manner.

PHASE III: Produce commercial production grade tools, distribute and support.

N93-289 TITLE: Airborne Sensor Front End Signal Processing Unit

CATEGORY: Exploratory Development

OBJECTIVE: To develop a compact, real-time electronic device capable of performing non-uniformity correction for 256x256 staring focal plane array sensors. Additionally, optimized bit compression to 8 bit format is desired but not required.

DESCRIPTION: High efficiency staring focal plane array sensors are becoming available in large numbers and low costs as to be desirable for airborne Navy applications such as surveillance, precision strike, and missile warning. Such sensors have reduced capability due to spatial
non-uniformities. Spatial, temporal, and neural methods may be used to reduce such non-uniformities close to the temporal noise level without constant recalibration. Real-time correction of such sensors in compact hardware would be desired for both Navy, DoD, and commercial applications. Additionally, intelligent (optimized as opposed to truncated) compression of 12 bit focal plane array video imagery into 8 bit video format is desirable from a standpoint of practicality.

PHASE I: Is to design and characterize a real time non-uniformity corrector capable of operating on a 256x256 focal plane array operating at 30 Hz. The electronics should be packaged according to commercial standards with the ability to function in flight, weigh less than 15 pounds and have less than 1 liter volume. The corrector shall be such that further reduction of volume to under 100 cm**2 does not require drastic reconfiguration.

PHASE II: Is to construct such a device and test it using a MWIR or LWIR high quantum efficiency focal plane array. Performance of the correction technique shall be characterized. Optimal video bit compression is desired but not a requirement.

N93-290 TITLE: Airborne Multispectral Sensor Arrays

CATEGORY: Exploratory Development

OBJECTIVE: To develop a practical airborne staring focal plane array sensor for Navy applications in surveillance, precision strike, and/or missile warning. Such a sensor should have closely aligned frames in two or more selected spectral bands.

DESCRIPTION: Staring focal plane array sensors with high quantum efficiency are becoming available in large numbers. Applications such as missile warning, precision strike, and overhead surveillance are enhanced by use of closely aligned multispectral imagery for clutter reduction and enhancement of desired features / contrast. Techniques to implement practical, effective, and inexpensive airborne multi-color sensors are needed. The contractor is expected to have one or two key personnel with security clearances for discussion of desired spectral bands within MWIR and/or LWIR spectral bands. Spectral bandwidths of .1 to .5 microns wide are desired for various applications.

PHASE I: Is to design a focal plane array sensor capable of multi-spectral operation. At least one spectral band should be in the 3.8 - 4.8 micron band with at least one other spectral band either in MWIR or LWIR. Attention should be paid to practicality for mass production and airborne integration.

PHASE II: Is to develop and demonstrate a focal planearray sensor camera with at least 256 x 256 pixels, capable of being fitted with 2 lenses: one in the 6 - 30 degree field of view and the other 60 - 90 degree field of view. The sensor need not be compact or ruggedized for airborne use; however, it should be transportable for ground/sea/hilltop data gathering AND its design should not be such that the technology could be later adapted for aircraft use.

N93-291 TITLE: Passive Tracking for Countermeasure Effectiveness

CATEGORY: Exploratory Development

OBJECTIVE: To develop, code, and validate algorithms for a passive fine tracker capable of rapidly determining when a guided missile has been effectively been rendered non-threatening by soft-kill (e.g. RF/EO/IR/MMW electronic warfare countermeasures) means.

DESCRIPTION: Navy aircraft are vulnerable to smart (guided) missiles. While Electronic Warfare (EW) countermeasures exist and are being further developed for Navy aircraft, these counter-measures, even when successful do not produce prompt missile hard kill. The pilot's lack of knowledge of the effectiveness of the EW suite could lead to dwelling on an already negated target, using ineffective technique, or prematurely ceasing employment of a countermeasure technique prior to its being effective. With prompt, reliable countermeasure effectiveness, one might reduce the number of expendibles used, optimize jamming/spoofing strategies, and decrease the single-shot susceptibility of the Navy aircraft. The SBIR effort will focus on use of sub-milliradian accuracy passive fine tracking with an optional parametric excursion into use of an active ranger for 3-dimensional trajectory tracking. Detailed missile flyout codes such as DISAMS and ESAMS are available as GFE. Contractor security clearance and computational facilities to the SECRET/NOFORN/WNINTEL level are required.

PHASE I: Is to develop and test algorithms for passive countermeasure effectiveness. At least 1 surface-to-air and one air-to-air missile type must be studied.

PHASE II: Is to code in real-time software, a precision pointer-tracker (GFE hardware or equivalent imagery simulation may be used). Tracker noise, latency, and jitter issues must be addressed. Software will be tested on data or engagement simulations for at least 6 different anti-air missile types. The tracker must be sensitive to track burning and post-burnout missiles with sufficient signal/noise for as required.

PHASE III: Possible follow-on to Airborne IRCM ATD's or applicability to shipboard SLQ-32/54 MATES follow-on

NAVAL AIR WARFARE CENTER/CHINA LAKE

N93-292 TITLE: Pulsed Detonation Engine

CATEGORY: Exploratory Research; Air-Breathing Propulsion

OBJECTIVE: To establish a basis for the Pulsed Detonation Engine (PDE) and prepare a proposal that would detail the applicability of PDE technology to Navy Missile Systems that are either existing, are under current development, or under consideration.

DESCRIPTION: With the recent reduction in defense funding, a need arises for a propulsion concept that is less expensive but offers higher performance than propulsion systems currently in use. The Pulse Detonation Engine embodies such a concept. PDEs employ an air breathing, constant volume process, marked by high gas pressures (10-100 atmospheres) and temperatures (>2000^{o} C). These are conditions with higher power densities than conventional engines.
Like all air breathing engines, PDEs offer a higher specific impulse than solid rocket motors. But unlike turbojets, PDEs do not require mechanical devices to compress the air prior to combustion; and unlike ramjets, they do not need to convert inlet air velocity into pressure. Since no pre-compression of gasses is required, the engine is very light and mechanically simple.
Recent analysis has indicated that a single PDE configuration can operate at a broad range of Mach numbers, $0.2<M<3.0$, in a fuel efficient manner. Feasibility studies done in the 50's and 60's involving tests of a single linear tube operating under intermittent combustion resulted in specific impulses above 2100 sec; recent simulations had specific impulses in excess of 4000 sec. Recent experiments at the Naval Postgraduate School have 1) established the feasibility of intermittent fuel injection at a chosen frequency, 2) shown the effectiveness of self aspiration and 3) shown the demonstrability of a primary detonation as a driver for the main detonation.

PHASE I: Compile a feasibility study to determine a missile-applicable PDE configuration. Determine which missile/mission profile would most benefit. Conduct performance trade-offs between PDEs and conventional engines as applied to Navy missiles. Synthesize preliminary designs of both heavyweight and flightweight hardware, preferably modular for ease of retrofit. All relevant issues must be addressed: structures, harmonic coupling, especially sensitivity.

PHASE II: Fabricate heavyweight hardware and conduct testing, proving the operability of the ideal PDE configuration.

N93-293 TITLE: M197, 20mm Sabot Deflector Retrofit Kit

This topic is CANCELLED.

N93-294 TITLE: Electrochemical Milling/Finishing of Rifling in Gun Barrels

CATEGORY: Engineering Development; Flexible Manufacturing

OBJECTIVE: To develop techniques to accurately and efficiently electrochemically mill the interior surface and rifling in medium caliber (20mm to 30mm) automatic cannon barrels.

DESCRIPTION: A need exists to improve the finishing and rifling of medium caliber gun barrel bores. Techniques that would provide a more accurate bore and rifling while increasing the process speed is desired. Further a process is required that does not induce residual stresses or effect the heat treat condition of the barrels during this finishing process. The resulting finish should be such that the barrels are amenable to hard coat plating after the smoothing-rifling process.

PHASE I: This task would involve using electrochemical milling techniques to (1) finish the bores of two 25mm automatic cannon barrels and (2) cut rifling grooves in these two barrels. The production capabilities of these techniques would be demonstrated.

The finished bore shall have an internal diameter of $25.05^{\pm}0.03$mm throughout the length of the rifled section and shall have a surface finish of 20 rms or better. The depth of the rifling grooves shall be 0.53±0.02mm with the sides and bottom of the groove also having a 20 rms surface finish. There shall be 19 grooves equally spaced around the internal diameter of the barrel. The lands and grooves shall be equal in width. The corners of the lands shall be sharp with no more than a 0.05mm radius and the groove bottom radius shall not exceed 0.20mm. The rifled length of the barrel shall be at least 70 inches. The process must be capable of producing either a constant twist or a progressive gain twist rifling schedule. Production rates on the order of 15 inches of barrel rifling or finishing per minute are required for constant twist rifling.

PHASE II: This effort would thoroughly test the Phase I deliverable items consisting of the two finished gun barrels for tests, a data package on the equipment used for finishing the barrels and a process description.

PHASE III: None currently planned.

N93-295 TITLE: Develop an Improved Thrust Vector Control Jet Vane

CATEGORY: Exploratory Research; Air-Breathing Propulsion

OBJECTIVE: The objective of this work is to develop an improved thrust vector control jet vane for missile control system applications. Innovative methods are sought to improve on the state of the art with respect to jet vane airfoil performance, durability, weight, and cost. Innovations can include new materials and/or new design approaches that address problems outlined below.

DESCRIPTION: Thrust vector control vanes are generally thick short span double wedge airfoils using a large mass of material to provide heat capacity. Currently, transpiration cooling is used to enable a vane to handle the

high heat transfer environment of a rocket plume. A refractory metal matrix infiltrated with a sacrificial coolant metal (e.g. Copper-Infiltrated Tungsten) provides structural strength and abrasion resistance. Basic improvements are needed to reduce weight, improve abrasion resistance, yet meet severe thermal conditions that are a significant part of the problem. The stagnation point temperature can exceed 6000 F. For undeflected vanes in 18% Aluminum propellant stagnation point heat transfer is on the order of 5.5 btu/sec/ft^2/F. Sidewall heat transfer may exceed 0.6 btu/sec/ft^2/F. Thus the thermal conductivity of the material should exceed that of copper. Additionally, the vane surface material should have a hardness capable of withstanding the abrasion caused by hot alumina in the rocket plume exhaust.

PHASE I: Under the Phase I feasibility study a tradeoff of concepts should be developed leading to a proposed design for Phase II. The degree of success in meeting or exceeding benchmark design goals will be used to judge performance potential from the proposed Phase I design. Benchmarks include an airfoil thickness to chord ratio of less than 15%, a vane density of less than 0.6 lb/in^3, predicted vane erosion of less than 25% mass for a 4 second exposure to an 18% Aluminized HTPB propellant plume. A suitable mechanical interface will allow attachment and actuation. It must be feasible to actuate the vane through or around a nozzle wall and provide protection of actuation hardware from (25 psi) exhaust gases.

PHASE II: The ability to show that a device can withstand the thermal conditions will be an important part of the Phase II effort. A prototype will be designed and tested under this portion of the effort.

NCCOSC/NRAD/SAN DIEGO

N93-296TITLE: Microcircuit Device Package Marking and Recognition

CATEGORY: Advanced Development

OBJECTIVE: Assess current defects, define requirements and do a technology assessment of microelectronic product marking or labeling methods. Provide a preliminary design of a marking and recognition system using a suitable method such as bar code, labeling, or character marking that shows a possibility of meeting requirements. Although this work will benefit the electronics packaging industry as a whole, only the requirements for hybrid microelectronics manufacturers should be addressed.

DESCRIPTION: The manufacturers who presently develop electronic packaging for the military require improved package marking or labeling techniques during their manufacturing process. The package markings must withstand stringent requirement as detailed in Mil-Std 883D. (A copy of Mil-Std 883D may be obtained from the Naval Supply Systems Command contact listed in the front of this Navy section).
The markings facilitate product tracking during the manufacturing process but also provide a means of meeting the traceability requirements for manufacturing military electronic packages that are associated with various weapon, electronic warfare, command and control, surveillance, and intelligence systems. The most widely used marking process is accomplished by painting over part of the gold surface electronic package, to eliminate reflectivity or contrast problems, then laser etching to the painted surface. During the manufacturing process, the electronic package is exposed to cleaning solvents that can destroy the painted surface making the markings unreadable with traditional bar code technology or character recognition techniques. Other marking processes result in adherence problems and corrosion from excessive marking depth.

PHASE I: System analysis support in the definition and assessment of marking requirements used by the hybrid microelectronics industry will be provided. This includes the applicable sections of the appropriate standards; Mil-H-38534, Mil-Std-883D, Mil-Std-1189. The contractor shall evaluate and determine estimates of costs associated with the various marking and labeling methods and technologies. Costs and feasibility of correcting deficiencies in existing methods and technologies should also be made. Actual or estimated list prices of current off-the-shelf marking, labeling, and recognition equipment are also desirable. Various technologies which should be investigated include but are not limited to laser marking, laser scribing, engraving, labeling, direct circuit writing.

PHASE II: A preliminary system architectural design of a system that meets military requirements shall be accomplished. This systems engineering effort will include hardware and software analysis, trade-off and

optimization studies, and development of preliminary system specifications. The design must specifically address the requirements identified in Phase 1.

PHASE III: A marketable product that meets government and industry needs.

NAVAL AIR WARFARE CENTER/POINT MUGU

N93-297 TITLE: Integrated IR/RF Scene Generation for Closed-Loop Missile Engagement Simulators

CATEGORY: Engineering Development; Simulation

OBJECTIVE: Incorporate IR scene simulation capability into an existing, closed-loop RF missile engagement simulation laboratory.

DESCRIPTION: The requirement to develop, test and evaluate multispectral (IR/RF) seekers has stimulated much recent activity in IR scene generation technology. Scene combination, the overlay of a registered IR scene (image) on an RF simulation has proven to be one of the most challenging requirements and is the subject of a current innovative research effort. This research will culminate in development of a dichroic (beamsplitter) screen for hardware-in-the-loop laboratories which is reflective in the infrared (IR) region and transmissive in the microwave region. It is desired that this beam combiner be incorporated into an existing, closed-loop RF missile engagement simulation laboratory.

PHASE I: Develop a preliminary design for incorporation of the dichroic screen into an RF test facility. Critical questions and issues to be resolved include: Number of degrees of freedom required,Image distortion as scene incidence angle is varied, Pattern cell size, System integrity under high angular rates, and Coordination of motion control.

PHASE II: Develop a detailed design which satisfactorily address critical design issues mentioned above and uncovered during the Phase-I feasibility analysis.

PHASE III: Funding of Phase III expected from various NAVAIR managers.